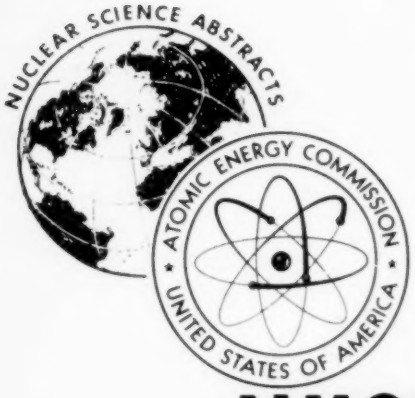
THE UNIVERSITY
OF MICHIGAN
SEP 27 1963
ENGINEERING
LIBRARY



NUCLEAR SCIENCE ABSTRACTS

Volume 17 Number 16
Abstracts 26944 – 28587

August 31, 1963

UNITED STATES ATOMIC ENERGY COMMISSION
Division of Technical Information

USAEC DEPOSITORY LIBRARIES

Collections of USAEC reports are maintained in the libraries of the organizations listed below for reference use by the general public. Facilities for making photocopies are available. The USAEC also makes available through these libraries atomic energy reports of countries other than the U. S. that are abstracted in *Nuclear Science Abstracts*.

ALABAMA
Auburn, Auburn University
Birmingham, Public Library

ARIZONA
Tucson, University of Arizona

ARKANSAS
Fayetteville, University of Arkansas

CALIFORNIA
Berkeley, University of California
Los Angeles, University of California
Menlo Park, Stanford Research Institute
San Diego, Public Library

COLORADO
Boulder, University of Colorado
Denver, Public Library

CONNECTICUT
New Haven, Yale University

DELAWARE
Newark, University of Delaware

DISTRICT OF COLUMBIA
Washington, Library of Congress

FLORIDA
Coral Gables, University of Miami
Gainesville, University of Florida

GEORGIA
Atlanta, Georgia Institute of Technology

HAWAII
Honolulu, University of Hawaii

ILLINOIS
Chicago, John Crerar Library
Chicago, University of Chicago
Evanston, Northwestern University
Urbana, University of Illinois

INDIANA
Indianapolis, Public Library
Lafayette, Purdue University

IOWA
Ames, Iowa State University

KANSAS
Manhattan, Kansas State University

KENTUCKY
Lexington, University of Kentucky
Louisville, University of Louisville

LOUISIANA
Baton Rouge, Louisiana State University
New Orleans, Tulane University

MARYLAND
Baltimore, Johns Hopkins University

MARYLAND (CONT.)
College Park, University of Maryland

MASSACHUSETTS
Cambridge, Harvard University
Cambridge, Massachusetts Institute of Technology

MICHIGAN
Ann Arbor, University of Michigan
Detroit, Public Library

MINNESOTA
Minneapolis, University of Minnesota

MISSOURI
Kansas City, Linda Hall Library
Rolla, University of Missouri School of Mines and Metallurgy
St. Louis, Washington University

MONTANA
Bozeman, Montana State College

NEVADA
Reno, University of Nevada

NEW JERSEY
Princeton, Princeton University
Teaneck, Fairleigh Dickinson University

NEW MEXICO
Albuquerque, University of New Mexico

NEW YORK
Albany, The University of the State of New York
Buffalo, University of Buffalo
Ithaca, Cornell University
New York, Atomic Industrial Forum, Inc.
New York, Columbia University
New York, New York University
Rochester, University of Rochester
Schenectady, Union College
Syracuse, Syracuse University
Troy, Rensselaer Polytechnic Institute

NORTH CAROLINA
Charlotte, Charlotte and Mecklenburg County Public Library
Durham, Duke University
Raleigh, North Carolina State College

NORTH DAKOTA
Grand Forks, University of North Dakota

OHIO
Cincinnati, University of Cincinnati
Cleveland, Public Library
Columbus, Ohio State University
Toledo, University of Toledo

OHIO (CONT.)
Youngstown, Youngstown University

OKLAHOMA
Norman, University of Oklahoma
Stillwater, Oklahoma State University

OREGON
Corvallis, Oregon State College
Portland, Reed College

PENNSYLVANIA
Philadelphia, University of Pennsylvania
Pittsburgh, Carnegie Library
University Park, Pennsylvania State University

PUERTO RICO
Rio Piedras, University of Puerto Rico

RHODE ISLAND
Providence, Brown University

SOUTH CAROLINA
Columbia, University of South Carolina

TENNESSEE
Knoxville, University of Tennesse
Memphis, Public Library
Nashville, Joint University Libraries
Oak Ridge, Oak Ridge Institute of Nuclear Studies

TEXAS
Austin, University of Texas
College Station, Agricultural and Mechanical College of Texas
Dallas, Southern Methodist University
Houston, Rice Institute
Lubbock, Texas Technological College
San Antonio, Public Library

UTAH
Salt Lake City, University of Utah

VIRGINIA
Blacksburg, Virginia Polytechnic Institu
Charlottesville, University of Virginia

WASHINGTON
Pullman, Washington State University
Seattle, University of Washington

WEST VIRGINIA
Morgantown, West Virginia Universit

WISCONSIN
Madison, University of Wisconsin
Milwaukee, Public Library

WYOMING
Laramie, University of Wyoming

Volume 17, Number 16, August 31, 1963

NUCLEAR SCIENCE ABSTRACTS

A semimonthly publication of the USAEC Division of Technical Information, Edward J. Brunenkant, Director. Published by the USAEC Division of Technical Information Extension, Robert L. Shannon, Extension Manager.

NUCLEAR SCIENCE ABSTRACTS is the only comprehensive abstracting and indexing service devoted solely to the literature of nuclear science and technology. Published twice each month since 1947, NSA provides coverage of (1) technical reports of the United States Atomic Energy Commission and its contractors, (2) technical reports of government agencies, universities, and industrial and independent research organizations in the United States and abroad, and (3) the book, patent, and journal literature, on a world-wide basis.

MANAGING EDITOR
John W. Norris

ASSISTANT MANAGING EDITOR
Donald D. Davis

ASSOCIATE EDITOR
Robert C. Kelly

PRODUCTION EDITOR
Lawrence T. Whitehead

TECHNICAL EDITOR
David E. Bost

INDEX EDITOR
Everett J. Hoffman

EVALUATORS
William D. Matheny
John H. Mitchell
Mary H. Newman
Lee M. Thompson

SUBJECT AUTHORITY EDITOR
Thomas R. Henley

CORPORATE AUTHORITY EDITOR
Clara L. Fox

ABSTRACTORS
D. Lamar Cason
Henry H. Dix
James R. Dulaney
Bernard O. Griggs
Harry G. Grisham
Mary Catherine Grissom
Miriam P. Guthrie
Phyllis Hansen
Thomas F. Heagerty
Carolyn D. Houston
Rose V. Jermain
Julia Redford
Ned W. Rizzardi
Charles E. Stuber
Anne G. Ward
David C. West

EXCHANGES
Margaret L. Pflueger

SCHEDULING AND PUBLISHING COORDINATOR
Henry H. Lansford

Communication concerning the editorial policy and content of NSA should be addressed to the Managing Editor, NUCLEAR SCIENCE ABSTRACTS, AEC Division of Technical Information Extension, P.O. Box 62, Oak Ridge, Tennessee.

ARRANGEMENT OF ABSTRACTS

Informative abstracts are arranged according to several categories and subcategories as illustrated by the Table of Contents. Author-abstracts are frequently used. A single abstract is presented for a single report or article. In the case of comprehensive progress reports, or conference proceedings and symposia, an abstract is provided both for the whole publication and for each individual topic, section, or paper. The subject matter of the item abstracted determines the placement of an abstract into the category arrangement. In certain instances more than one category could be considered for an abstract. In such cases, the category which encompasses most of the subject matter of the item is selected, and "see" references are provided at other appropriate category headings.

INDEXES TO NSA

Regular Cumulations. Each issue of NSA includes indexes for personal author, corporate author (issuing organization), subject, and report number. These indexes are cumulated quarterly, semiannually, and annually. The entries in the report number index cite, when known, the sources through which the report is made available and, if appropriate, the price. Report numbers also appear in the personal author, subject, and corporate author indexes. The personal and corporate author indexes include "short titles" of the items indexed. The subject index consists of main headings that are generally names of specific materials or objects followed by modifiers that describe the properties of, and processes applied to, the subject of the main headings. Cross references ("see" and "see also" references) appear in the cumulative indexes. Index entries are arranged according to the word-by-word alphabetic system.

Multivolume Subject and Author Accumulations. A cumulated author and subject index covering Volumes 1 through 4 (July 1948–1950) is included in the bound Volume 4 which is available from the Johnson Reprint Corporation, 111 Fifth Ave., New York, N. Y. ($30.00). A subject and author index covering Volumes 5 through 10 (1951–1956) is available from the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C. ($5.25).

A cumulated index covering Volumes 11–15 (1957–1961) is available from the U. S. Government Printing Office, Washington 25, D. C., as follows: Subject Index ($19.00), Personal Author Index ($14.25), and Corporate Author Index ($2.50).

Cumulative Report Number Index. A report number index is issued annually that includes all reports contained in all volumes of NSA together with public availability citations. The Cumulative Report Number Index, Vols. 1–16, will be available from the U. S. Government Printing Office, Washington 25, D. C., ($4.50).

AVAILABILITY OF PUBLICATIONS ABSTRACTED

Public availability of all U. S. Atomic Energy Commission reports is indicated in the Report Number Index. Also included, when known, is the availability of many reports of other government agencies and organizations, both in the United States and abroad.

The availability of certain unnumbered reports abstracted in NSA is included in the abstract. The abbreviation GPO indicates that the material is available from the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C.

Journal articles, books, and other published materials are available through standard commercial subscriptions or library sources.

Dissertations taken from DISSERTATION ABSTRACTS are available from University Microfilms, Inc., 315 N. First Street, Ann Arbor, Michigan.

Many of the published materials abstracted in NSA are deposited in the Library of the Oak Ridge Institute of Nuclear Studies (a USAEC Depository Library) and are available on interlibrary loan from that source.

DEPOSITED BY THE
UNITED STATES OF AMERICA

TABLE OF CONTENTS

Volume 17, Number 16, August 31, 1963

Category	Page
GENERAL AND MISCELLANEOUS	3537
BIOLOGY AND MEDICINE	3540
General and Miscellaneous	3540
Biochemistry, Nutrition, and Toxicology	3547
Fallout and Ecology	3554
Radiation Effects on Living Tissues	3555
Radiation Sickness	3580
CHEMISTRY	3582
General and Miscellaneous	3582
Analytical Procedures	3583
Inorganic and Physical Chemistry	3593
Organic Chemistry	3605
Radiation Chemistry and Radiochemistry	3606
Raw Materials and Feed Materials	3617
Separation Processes	3618
ENGINEERING AND EQUIPMENT	3621
General and Miscellaneous	3621
Heat Transfer and Fluid Flow	3624
Materials Testing	3627
GEOLOGY, MINERALOGY, AND METEOROLOGY	3628
HEALTH AND SAFETY	3631
INDUSTRIAL APPLICATIONS OF ISOTOPES AND RADIATIONS	3638
INSTRUMENTS AND INSTRUMENTATION	3641
General and Miscellaneous	3641
Radiation Detection	3645
ISOTOPE SEPARATION	3649
MATHEMATICS AND COMPUTERS	3650
METALS, CERAMICS, AND OTHER MATERIALS	3651
General and Miscellaneous	3651
Corrosion	3653
Fabrication	3655
Properties and Structure	3658
Radiation Effects	3673
PHYSICS	3681
General and Miscellaneous	3681
Astrophysics and Cosmology	3703
Cosmic Radiation	3705
Criticality Studies	3707
Elementary Particles and Radiations	3707
Neutron Physics	3717
Nuclear Properties and Reactions	3719
Particle Accelerators	3734
Plasma Physics and Thermonuclear Processes	3735
Shielding	3741
Theoretical Physics	3741
REACTOR TECHNOLOGY	3743
General and Miscellaneous	3743
Power Reactors	3757
Research Reactors	3761
SPACE APPLICATIONS AND TECHNOLOGY	3763
WASTE DISPOSAL AND PROCESSING	3764
CORPORATE AUTHOR INDEX	INDEX-1
PERSONAL AUTHOR INDEX	INDEX-9
SUBJECT INDEX	INDEX-43
REPORT NUMBER INDEX	INDEX-106

HOW TO OBTAIN NUCLEAR SCIENCE ABSTRACTS

Subscription. The semimonthly abstract issues and the four cumulated-index issues are available postpaid on subscription and in single copy from the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C., at the prices indicated below:

- SEMIMONTHLY ISSUES. Annual subscription rate: $22.00, domestic; $27.50, foreign. Price per single copy: $1.25, domestic; 25 per cent extra for foreign mailing.
- CUMULATIVE-INDEX ISSUES. Annual Subscription rate: $22.00, domestic; $25.00, foreign. Price per single copy varies according to the number of pages. The Cumulative Report Number Index, Vols. 1–17, will also be available separately from the Superintendent of Documents, U. S. Government Printing Office, at a price to be announced later.
- DOMESTIC SUBSCRIPTION RATES apply to the United States, Canada, Mexico, and all Central and South American countries, except as noted below.
- FOREIGN SUBSCRIPTION RATES apply to Argentina, Brazil, British and French Guiana, Surinam, British Honduras, and all other countries throughout the world.

Exchange. NSA is also available on an exchange basis to universities, research institutions, industrial firms, and publishers of scientific information. Inquiries should be directed to the Division of Technical Information Extension, U. S. Atomic Energy Commission, P. O. Box 62, Oak Ridge, Tennessee.

Availability to Government Agencies. NSA is available free of charge to U. S. Government Agencies upon request to the Division of Technical Information Extension, U. S. Atomic Energy Commission, P. O. Box 62, Oak Ridge, Tennessee.

NOTE ON TRANSLATIONS

The literature of nuclear science and technology is abstracted and indexed in NUCLEAR SCIENCE ABSTRACTS where possible from the original language. Abstracts of translations appear in NSA only when the original material was not available. For translations of the original language material appearing in NSA into other languages, including English, such sources as: (1) "USAEC Translation Lists" and TID-4025 "Translation Title List and Cross Reference Guide" published by the Division of Technical Information, U. S. Atomic Energy Commission and (2) TECHNICAL TRANSLATIONS published by the Office of Technical Services, U. S. Department of Commerce should be consulted. Source (1) is available at all AEC domestic and foreign depositories. Source (2) is available on subscription from the Superintendent of Documents, U. S. Government Printing Office, annual subscription $12.00 ($4.00 additional for foreign mailing).

Legal Notice

The AEC reports listed in this document are accounts of Government sponsored work. Neither the United States, nor the Commission, nor any person acting on behalf of the Commission:

A. Makes any warranty or representation, expressed or implied, with respect to the accuracy, completeness, or usefulness of the information contained in these reports, or that the use of any information, apparatus, method, or process disclosed in these reports may not infringe privately owned rights; or

B. Assumes any liabilities with respect to the use of, or for damages resulting from the use of any information, apparatus, method, or process disclosed in these reports.

As used in the above, "person acting on behalf of the Commission" includes any employee or contractor of the Commission, or employee of such contractor, to the extent that such employee or contractor of the Commission, or employee of such contractor prepares, disseminates, or provides access to, any information pursuant to his employment or contract with the Commission, or his employment with such contractor.

Use of funds for printing this publication approved by the Director of the Bureau of the Budget, May 20, 1963.

Volume 17, Number 16 August 31, 1963

NUCLEAR SCIENCE ABSTRACTS

GENERAL AND MISCELLANEOUS

26944 (BMI-1630(Del.)) PROGRESS RELATING TO CIVILIAN APPLICATIONS DURING APRIL 1963. Russell W. Dayton and Ronald F. Dickerson (Battelle Memorial Inst., Columbus, Ohio). May 1, 1963. Contract W-7405-eng-92. 81p.

The projects reported on include the following: wear of sliding surfaces in sodium; development of fuel alloys; fission product release from fuels; cermet fuels; radioinduced graft polymerization; development of a tracer system for filter evaluation; properties of Zr alloys and UO_2; development of coated fuel particles and matrix fuels; irradiation studies; corrosion by boiling NbF_5; creep-rupture properties of SAP; and fission product deposition in loops. (D.L.C.)

26945 (CEX-62.6.2) FORT McCLELLAN RADIOLOGICAL INSTRUCTION AREA (ARMS-II). R. B. Guillou (Edgerton, Germeshausen and Grier, Inc., Santa Barbara, Calif.). Mar. 26, 1962. Contract [AT(29-1)-1183]. 17p.

An aerial radiological survey was made to test and evaluate the operation of the ARMS-II system over a high-intensity radiation field of small area. The radiation area was about 1000 yards long and less than 300 yards wide. The sources (Co^{60}) produce a dose rate of about 300 mr/hr along the center line. Data from an areal survey of the range were contoured to show the distribution of the gamma-ray flux at 550 ft above the ground. The count rate over the center of the range was greater than 15,000 counts/sec on the low-sensitivity detector. Data on the air attenuation of gamma rays were collected from flights along the center line of the range at altitudes ranging from 100 to 3500 ft above the ground. Maximum count rates on low sensitivity ranged from more than 50,000 counts/sec at 100 ft to 1300 counts/sec at 1300 ft. Maximum count rates on high sensitivity ranged from more than 50,000 counts/sec at 1500 ft to about 2000 counts/sec at 3500 ft above the ground. (C.H.)

26946 (LAMS-2895) SELECTED BIBLIOGRAPHY OF PUBLICATIONS OF LASL RESEARCH 1957-1962. Barbara Hendry and Marjorie Johnson (Los Alamos Scientific Lab., N. Mex.). Apr. 17, 1963 Contract W-7405-eng-36. 368p.

All publications other than LA and LAMS reports that appeared during the years 1957-62 and that covered work done at the Los Alamos Scientific Laboratory are included in 2062 references. Entries are arranged first by year and then alphabetically by first author. Abstracts are separated from full papers and are arranged in a separate alphabet at the end of each year's listing. Entries are designated by numbers beginning with the last two figures of the year of publication; numbers for abstracts carry the letter A at the end. An addendum listing publications discovered after the main body of the bibliography had been prepared has entries designated with numbers beginning with Add-. They are arranged alphabetically by first author regardless of year of publication. An author index and listing by LADC number is given for all entries, including those in the addendum. A tabulation of the number of papers published in each journal appears in Appendix I. (N.W.R.)

26947 (SCR-600) BIBLIOGRAPHY ON CIVILIAN APPLICATION RELEASES THROUGH 1962. (Sandia Corp., Albuquerque, N. Mex.). Jan. 1963. 86p.

This bibliography, a revision of SCR-500, gives a cumulative numerical listing of the Sandia Corporation technical papers available to the public from the Office of Technical Services, Department of Commerce, Washington 25, D. C. Prices for printed, photostatic, facsimile, or microfilm copies are included for many of the listings. Besides the document releases, the title list includes a section on engineering drawings and specifications on sale through AEC's Engineering Materials Section at Oak Ridge. The literature and engineering materials covered by the bibliography have been made available to the public under the Civilian Application Program of the Atomic Energy Commission by Sandia Corporation, a prime contractor to the AEC. (auth)

26948 (TID-3717) INFORMAL LISTING OF BIBLIOGRAPHIES OF ATOMIC ENERGY LITERATURE. Bibliographies Issued or in Progress During the Period, April–May 1963. (Division of Technical Information Extension, AEC). 28p.

Bibliographies issued or in progress during the period April and May 1963 are listed. A list of 74 bibliographies issued and 73 bibliographies in preparation is given. A combined subject and author index is presented along with a report number index. The bibliographies are listed alphabetically according to AEC contractors or other agencies. Information covers all fields of atomic energy. (N.W.R.)

26949 (TID-18887) THE PRECISION-ENCODED MEMORY (PEM). PHOTOGRAPHY AND READ-BACK OF PRECISION-ENCODED DATA. I. A. Pless, L. Rosenson (Massachusetts Inst. of Tech., Cambridge and Massachusetts Inst. of Tech., Cambridge. Lab. for Nuclear Science); and A. H. Rosenfeld (California. Univ., Berkeley. Lawrence Radiation Lab. and California. Univ., Berkeley). [June 26, 1963]. Contract AT(30-1)-2098. 15p.

The equipment and techniques used with the precision-encoded memory (PEM) to precision-photograph digital data in rectangular array of about 2000 × 2000 bits with glass plates or perforated films and to retrieve these bits with almost random access (with a maximum delay of 400 μsec) are described. An oscilloscope is used to encode and read back an array. The density in bits/linear in. of film is 500 times that on ½ in. magnetic tape, and the M.I.T. PEPR device can read this data at a bit rate of about 5 Mc. (D.C.W.)

26950 PROBLEMS ON THE CAUSAL RELATIONSHIP BETWEEN DAMAGE AND NUCLEAR INCIDENTS. Giuseppe Belli. Comit. Nazl. Energia Nucl., Notiziario, 9: No. 5, 49-51(May 1963). (In Italian)

Problems related to the cause-effect relationship between nuclear incidents and damages are described from a legal viewpoint. (J.S.R.)

26951 CALCULATION OF THERMAL REACTORS. TWO DISTINCT PHILOSOPHIES. Rafael Caro. Energia Nucl. (Madrid), 6: 19-23(Oct.-Dec. 1962). (In Spanish)

A comparative study was made of the applicability of the multigroup theory and the two-group theory to the calculation of a natural uranium, heavy water reactor. English reactors were used as reference. Both theories gave good results with respect to the construction of exponential or critical assemblies. The use, however, of the two-group theory for natural uranium reactors already in operation is shown, with the inference that these methods would be better for the DON project. (J.S.R.)

26952 URANIUM. Robert W. Bernick. Eng. Mining J., 164: 115-17(Feb. 1963).

A survey of the U market for 1962, with a future outlook, is presented. The situation in the U. S. is considered in some detail; conditions in Canada, Australia, South Africa, the United Kingdom, France, Japan, and India are also reviewed. (Uranium Abstracts, Vol. 2, No. 4, May 1963)

26953 URANIUM. Rafford L. Faulkner (U. S. Atomic Energy Commission, Washington, D. C.). Mining Congr. J., 49: 125-8(Feb. 1963).

Future prospects are outlined for the U market in the United States. Demands for U for use in power reactors are assessed; a substantial reduction in the cost of processing U fuel elements have a considerable influence on the setting up of new power installations. The known reserves of U appear to be inadequate for long-range use. (Uranium Abstr., Vol. 2, No. 4, May 1963)

26954 EFFECTS OF NUCLEAR EXPLOSIONS ON VERY-LOW-FREQUENCY AND LOW-FREQUENCY PROPAGATION. W. Riedler (Kiruna Geophysical Observatory, Sweden) A. Egeland, R. Lindquist, and A. Pedersen. Nature, 198: 1076-7(June 15, 1963).

Two Soviet nuclear explosions appear to have been made in Central Asia on Oct. 22 and 28, 1962. Magnetic disturbances recorded at Uppsala and Paris, and attributed to the explosions, are analyzed for mechanisms responsible for the observed sudden increase in very-low-frequency signal strength. (C.H.)

26955 SOME THEORETICAL ASPECTS OF ISOTOPE STUDIES. B. Jeijnse. Ned. Tijdschr. Geneesk., 106: 1512-14(July 21, 1962).

26956 RADIATION QUANTITIES AND UNITS, ICRU REPORT 10a 1962. Hiroyoshi Iida (National Inst. of Radiological Sciences, [Japan]). Nippon Genshiryoku Gakkaishi, 5: 412-19(May 1963). (In Japanese)

The fundamental concepts and quantities employed in radiation dosimetry were reformed and clarified by the ICRU in 1962. At the same time, some radiation quantities and units are newly introduced. (auth)

26957 URANIUM AND ITS POTENTIAL MARKET. Jesse C. Johnson. Nucl. Energy, 166-8(June 1963).

Important developments in recent years and planned future developments in the field of nuclear power has clarified the near-term outlook for the uranium industry and provided a sound basis for longer range planning. The present estimated free-world uranium production is compared with a production chart projected to 1971. The United States and Canadian uranium reserves are estimated and the need for extensive exploration is indicated. (C.E.S.)

26958 PLOWSHARE. Edward Teller (Univ. of California, Berkeley). Nucl. News, 6: 1-13(Mar. 1963). (UCRL-7222)

A survey is presented of all aspects of peaceful applications of nuclear explosives: earth moving, large-scale chemical and mining engineering, and scientific experiments. (D.L.C.)

26959 DIRECT CONTACT AMONG GALACTIC CIVILIZATIONS BY RELATIVISTIC INTERSTELLAR SPACEFLIGHT. Carl Sagan (Stanford Univ., Palo Alto, Calif.). Planetary Space Sci., 11: 485-98(May 1963).

An estimate of the number of advanced technical civilizations on planets of other stars depends on our knowledge of the rate of star formation; the frequency of favorably situated planets; the probabilities of the origins of life, of intelligence, and of technical civilization; and the lifetimes of technical civilizations. These parameters are poorly known. The estimates lead to $\sim 10^6$ extant advanced technical civilizations in our galaxy. The most probable distance to the nearest such community is then several hundred light years. Interstellar spaceflight at relativistic velocities has several obvious advantages over electromagnetic communication among these civilizations. One striking feature is that with uniform acceleration of 1 g to the midpoint of the journey, and uniform deceleration thereafter, all points in the galaxy are accessible within the lifetime of a human crew, due to relativistic time dilation. Some of the technical problems in the construction of starships capable of relativistic velocities are discussed. It is concluded that with nuclear staging, fusion reactors, and the Bussard interstellar ramjet, no fundamental energetic problems exist for relativistic interstellar spaceflight. It is assumed that there exists in the galaxy a loosely integrated community of diverse civilizations, cooperating in the exploration and sampling of astronomical objects and their inhabitants. If each such advanced civilization launches one instellar vehicle per year, the mean time interval between samplings of an average star would be 10^8 years, that between samplings of a planetary system with intelligent life would be 10^4 years, and that between sampling of another advanced civilization would be 10^3 years. It follows that there is the statistical likelihood that Earth was visited by an advanced extraterrestrial civilization at least once during historical times. There are serious difficulties in demonstrating such a contact by ancient writings and iconography alone. Nevertheless, there are legends that might profitably be studied in this context. Bases or other artifacts of interstellar spacefaring civilizations might also exist elsewhere in the solar system. The conclusions are clearly provisional. (auth)

26960 SOME RECENT ACTIVITIES IN PLASMA TECHNOLOGY IN THE UNITED STATES. N. Hiester,

F. Halden, and C. Marynowski (Stanford Research Inst., Menlo Park, Calif.). TVF (Tek. Vetenskaplig Forskning), 34: 83-94(1963). (In English)

Plasma technology as applied to various aspects of materials working and chemical processing is reviewed. Recent advances in arc plasma torches, inductively coupled plasma torches, and materials coating, forming, and welding are presented. The capabilities of the plasma jet as a chemical processing tool are also considered. High temperature equilibria, nonequilibrium reactions, plasma pyrolysis of condensed phases, fuming and decomposition deposition, and diffusion reactions are discussed. (C.E.S.)

26961 CATALOG—RADIO AND STABLE ISOTOPES. 4th Revision. (Oak Ridge National Lab., Tenn.). Apr. 1963. Contract [W-7405-eng-26]. 99p. Free (ORNL).

Procedures for ordering radioisotopes are outlined, and shipping containers are described in some detail. Methods of production and assay of radioisotopes are described. Lists are given for both radioisotopes and stable isotopes. Finally, special materials and services are described. (D.L.C.)

26962 IZOTOPY. (Isotopes). Moscow, V. O. Soyuzkhimeksport, [1962]. 160p.

A prospectus of radioactive preparations available is presented. Characteristics of isotopes and their compounds, radiation sources, standard emitters, control and calibrated emitters, natural radioelements, isotope targets, enriched stable isotopes, stable isotopes, labelled compounds, packing and containers, and scintillation monocrystals are listed. (C.E.S.)

BIOLOGY AND MEDICINE

General and Miscellaneous

26963 (EUR-128.i) APPLICAZIONI DELL'ANALISI PER RADIOATTIVAZIONE ALLA BIOLOGIA. (The Use of Radioactivation Analysis in Biology). Margaret Merlini (European Atomic Energy Community. Nuclear Research Center, Ispra, Italy). 1962. 12p.

The principles of activation analysis and the methods of detection and measurement of radioactivity from neutron irradiated samples are described. The application of this method in different fields is mentioned. An example of the use of activation analysis in biology is given; and the results of a study on the manganese content in different parts of a lamellibranch, Unio mancus elongatus (Pfeiffer) of Lago Maggiore, are presented and discussed. (auth)

26964 (ORINS-42) MEDICAL DIVISION RESEARCH REPORT FOR 1962. (Oak Ridge Inst. of Nuclear Studies, Inc., Tenn.). Contract AT-40-1-GEN-33. 71p.

Progress is reported on studies of radiation effects and treatment of patients with a variety of malignant disorders. Emphasis was placed on the response of patients to homologous bone marrow injections after exposure to single whole-body radiation doses of 50 or 100 r. Results are included from complementary studies in laboratory animals. Data are presented on the effects of whole-body irradiation on bone marrow lipids in rats, dogs, swine, and monkeys; the radiosensitivity of the primate, Tamarinus nigricollis; the effects of injected rare earth chelates on liver; the tissue distribution of radioisotopes after intralymphatic injection; a tracer estimation of β dose to the human intestine from internally deposited radioisotopes; and an evaluation of radioisotopes for use in bone marrow scanning. A list is included of publications during the period covered by this report. (C.H.)

26965 RADIOIODINE THERAPY OF HYPERTHYROIDISM: WITH SPECIAL CONSIDERATION OF DOSE CALCULATION. Werner Schmitz (Universität, Munich). Aerztl. Forsch., 17: 237-40(May 10, 1963).

Attempts were made to derive a mathematical formula for calculating the optimal dose of radioiodine for effective treatment of hyperactivity without inducing myxedema. The effective half life time (T_{eff}) of I^{131} is related to the physical half life time (T_{phys}) and the biologic half life time (T_{biol}) by the expression: $1/T_{eff} = 1/T_{phys} + 1/T_{biol}$. T_{phys} for I^{131} has a value of 8.05 days, and T_{biol} is determined clinically by I^{131} uptake tests. Thyroid gland weight (G) in grams is related to the surface area (F) of the gland as follows: $G = 0.326\sqrt{F^3}$. Optimal doses to which thyroid tissue should be subjected to treat hyperthyroidism vary between 8000 and 10000 rad, whereas permanent myxedema may be incurred at doses above 15000 rad. It is assumed that I^{131} will be distributed homogeneously throughout the gland and that 90% of the total dose results from β radiation and 10% from γ radiation. The following expression was derived on the basis of these factors to calculate the dose of I^{131} (A, in mC): $A = D \times G/165.3 \times U_{max} \times T_{eff}$, where D represents the thyroid dose in rads (8000 to 10000) and U_{max} the maximum uptake of I^{131} by the thyroid (as percentage of injected dose). The value of T_{eff} does not remain constant throughout treatment, particularly in thyrotoxicosis, but may show an exponential decline. Recalculation of the dose on this basis is described. (H.H.D.)

26966 ON THE THERAPY OF MALIGNANT THYROID TUMORS. Christian Strohm and Heinz Czempiel (Universität, Munich). Aerztl. Forsch., 17: 240-50(May 10, 1963).

The relative advantages of various radiation treatments (200-kv x rays, Co^{60} γ rays, high-speed electrons, radioiodine) are discussed and results of thyroid dosimetric neck structures were used to measure thyroid doses under various types of radiation. Isodose diagrams obtained with a water-filled Plexiglas phantom showed that 6000-r, ventrally directed, combined Co^{60} and 17-Mev electron irradiation would be most effective delivering 60 to 90% of the surface dose to the gland. Under these conditions, vertebral bone marrow would receive only 10 to 20% of the superficial dose. I^{131} treatment of thyroid tumors has the disadvantage of low incorporation in some types of tumors and the advantage that it is taken up by metastases as well as the primary tumor. In general, 100- to 150-mC oral doses of I^{131} initially are recommended, to be followed 14 days later by a similar dose. The highest total dose given was 680 mC. Of patients given a single 120-mC dose of I^{131}, 44% showed a fall of circulating lymphocytes to a level 52% of the initial value. Two weeks after a 240-mC dose, the level fell sharply, and in 6 to 8 weeks myxedema was noted. Total circulating leukocytes fell to ~30% of normal by 1 month after a 120-mC dose. Of 62 patients with thyroid tumors treated with I^{131} and 200-kv x rays, only 18% were living after 1 yr. (H.H.D.)

26967 LONG-TERM STUDIES OF THE RAT RETICULOENDOTHELIAL SYSTEM AND ENDOCRINE GLAND RESPONSES TO FOREIGN PARTICLES. Howard H. Frankel, Paul R. Patek, and Sol Bernick (Univ. of Southern California, Los Angeles). Anat. Record, 142: 359-73 (Mar. 1962).

Changes in morphology and responses of macrophages to a single intravenous injection of carbon or thorium dioxide (Thorotrast) were studied in rats. Localization of C particles is described in detail, although an identical response of macrophages to ThO_2 was observed. In lever, C particles were observed in Kupffer cells lining the sinusoids of the hepatic lobule 24 hr after injection. At 48 hr the concentration of C increased within the hepatic lobule. The increased uptake of C by individual Kupffer cells eventually led to conglomeration of these macrophages and apparent sinusoidal occlusion. Only a minimal amount of C particles was observed in the lungs at one month, but migration of C-laden macrophages to lung from liver began one month after the injection and quickly ceased shortly afterward. There was a relative increase in the particles demonstrated in the spleen as the experiment progressed. Administration of the reticuloendothelial blocking agents resulted in morphological changes in the thyroid gland, anterior pituitary, and adrenals. Both C and ThO_2 produced a hyperplasia of the thyroid follicles. Concomitantly, there was a marked increase in the number of thyrotrophic cells of the anterior pituitary, suggesting thyrotropin production or release. There was also an increased infiltration of a sudanophilic positive substance into all the zones of the adrenal cortex. (H.H.D.)

26968 THE VALUE OF THE CERVICAL INCORPORATION OF RADIOACTIVE PHOSPHORUS (P^{32}) IN THE DIAGNOSIS OF CANCER OF THE UTERINE CERVIX. Alberto Zacutti and Giovanni Turchetti (Università, Pisa, Italy). Arch. Ostet. Ginecol., 66: 657-80(Nov.-Dec. 1961).

To explore a possible method for early diagnosis of cervical carcinoma, direct measurements were made of the radioactivity of the cervix after intravenous injection of 3 μC P^{32}-phosphate per kg body weight in 10 normal women and 25 with uterine pathology. Measurements were made with a Geiger-Mueller tube applied to the cervix at daily intervals for up to 9 days. Readings of less than 100 cpm were found with normal cervices, with a low maximum on the 2nd or 3rd day. Only slightly higher values were found in cases of cervical erosion and polyps. However, 4 to 5 times higher values were noted in early cases of cervical cancer. It is suggested that the method allows detection as well as exact localizations of malignant cells in the cervix. (H.H.D.)

26969 ESTIMATION OF DIFFUSION PRESSURE DEFICIT BY CORRELATION WITH RELATIVE TURGIDITY AND BETA-RADIATION ABSORPTION. P. C. Whiteman and G. L. Wilson (Univ. of Queensland, Brisbane). Australian J. Biol. Sci., 16: 140-6(Feb. 1963).

Diffusion pressure deficit (DPD), the most suitable index of the water status of plant tissue, expresses the total forces of water absorption, in the same units as may be used for water retention by the soil and atmosphere environment with which moisture exchange occurs. The possibility of estimation by correlation with more easily measured indices of water status was examined for leaf tissue of Sorghum vulgare. Two methods, involving relative turgidity (RT) and beta-radiation absorption, were investigated. Beta-radiation absorption is highly correlated with RT, sensitive to small RT changes, and can therefore provide a continuous nondestructive record of changes in the plant's water status. The variability in the beta-radiation absorption-RT relation was examined. The RT-DPD correlation provides an accuracy of estimate of about 10% of DPD values for a given leaf position on the plant at a constant stage of leaf expansion. Differences between leaf position and with varying physiological age of the one leaf reduce the usefulness of the correlation. However, beta-radiation absorption, while following the trend of water content, is inadequate for useful estimate of DPD. Beta-radiation absorption was shown to vary widely between the different leaves on one plant and between different plants, owing perhaps to thickness and density variations. The calculation of relative absorption reduced variability, and the data allow for an RT estimation of ±8.0%. (DTIE)

26970 NUCLEOPROTEINS IN REGENERATING RAT LIVER. II. A STUDY OF THE RAPIDLY LABELLED RIBONUCLEIC ACID. A. Hope McArdle (McGill-Montreal General Hospital Research Inst., Montreal). Biochim. Biophys. Acta, 68: 569-77(Apr. 30, 1963). (In English)

Incorporation in vivo of P^{32} into the RNA of normal and regenerating rat-liver cell fractions was carried out 8 to 12 hr following sham operation or partial hepatectomy. Before analysis of their RNA-P, the cell fractions were chromatographed on Ecteolacellulose. Evidence has been obtained that a highly metabolically active RNA is first synthesized in one of the nuclear fractions and is rapidly transferred to the cytoplasm where it first appears in the deoxycholate-soluble fraction of the microsomes, although at later times it would appear to be transferred to the cell supernatant. This active material has been compared to the messenger RNA described for bacterial systems. In short-term experiments it was suggested that the bulk of P^{32} incorporation into the ribosomes could be derived from the cell supernatant. (auth)

26971 A METHOD OF REDUCING THE INCIDENCE OF THE SECONDARY SYNDROME IN ALLOGENIC MARROW TRANSPLANTATION. Georges Mathé (Hopital Saint-Louis, Paris), Jean-Louis Amiel, Léon Schwarzenberg, and Anne-Marie Mery. Blood, 22: 44-52(July 1963).

Preservation of a graft of lymph node cells or semi-allogenic bone marrow cells at 37 C in Tyrode's solution for 2 hours, which reduces the percentage of cells not permeable to eosin by half, has a statistically significant reducing effect on the frequency of acute or chronic secondary syndromes which occur in irradiated recipients. Preservation at 18 C for 6 hours, which in the same way increases the percentage of cells permeable to eosin, does not have the same effect. These two methods of preserving bone marrow cells do not appreciably reduce the myeloid-restoring capacity of compatible or incompatible irradiated recipients. Application of these results to bone marrow grafting in clinical medicine is discussed. (auth)

26972 A COMPARISON BETWEEN THE LATE EFFECTS OF THOROTRAST AND A NON-RADIOACTIVE ZIRCONIUM HYDROXIDE SOL IN MICE. J. P. M. Bensted and J. O. Crookall (Inst. of Cancer Research, London). Brit. J. Cancer, 17: 62-9(Mar. 1963).

A comparison was made of the late effects of Thorotrast and a non-radioactive colloidal contrast medium, Zirconotrast, in mice. There was no significant difference in the incidence of liver tumors between these two groups and a group of control mice. One hemangio-endothelioma was seen in the Thorotrast group and a possibly similar tumor observed in the Zirconotrast group. The details of preparation of the Zirconotrast are also given. (auth)

26973 CANCER THERAPY—EVALUATION OF SUPERVOLTAGE X RAY. William R. Gaffey (Dept. of Public Health, Sacramento, Calif.). Calif. Med., 97: 316 (Nov. 1962).

Criticisms are advanced of the statistical treatment of previous studies purporting to show that supervoltage x-ray therapy is not more effective than orthovoltage therapy in treatment of cancer of tonsil and ovary. The formula used previously for chi-square was found to be in error. It should be multiplied by one less than the number of studies (16 for tonsil, 11 for ovary). This, plus the correction of minor arithmetic errors, leads to chi-squares of 69.97 (significant) for tonsil and 24.75 (significant at the 1% level) for ovary. It is suggested that further examination of the data should logically consist in deciding whether the observed variation is associated to any significant extent with variation in voltage. This can be done by calculating separate chi-squares for the variation within the high-voltage group, within the other group (ortho-voltage-not stated), and between the high-voltage and the other group. Since these represent all possible sources of variation, the chi squares add up to the overall chi square calculated above. For both organs, the significant variation occurs within the other group, not within the high-voltage group or between the 2 groups. Therefore the failure to find such a difference in the data is not a reason to conclude that none exists. Thus it was concluded that the previously presented data do not prove the equality of the 2 treatments. (TCO)

26974 THE FATE OF EHRLICH CELLS INJECTED INTO THE PORTAL SYSTEM. A. Koike, H. Nakazato, and G. E. Moore (Roswell Park Memorial Inst., Buffalo). Cancer, 16: 716-20(June 1963).

The fate of Ehrlich ascites tumor cells injected into the portal system in mice was studied. A majority of the cells lodged in the liver. When 10^5 Ehrlich cells were injected, one-third of the mice developed liver metastases. The greater the number of tumor cells injected, the greater the

extent to which the mice developed liver metastases. Apparently no viable latent tumor cells remained after the seventh day following tumor-cell inoculation in this particular system. Many of the tumor cells that lodged in the liver seemed to be inactivated within 4 days after cell inoculation. Treatment with cortisone, x radiation, carbon tetrachloride, or Thorotrast promoted the development of liver metastases. There is some evidence that these agents interfere with the activity of a tumor-inhibitory factor in the liver. (auth)

26975 CELL DIVISION: DIFFERENTIAL EFFECTS OF HEAVY WATER UPON THE MECHANISMS OF CYTOKINESIS AND KARYOKINESIS IN THE EGGS OF ARBACIA PUNCTULATA. D. Marsland and A. M. Zimmerman (New York Univ., New York and Marine Biological Lab., Woods Hole, Mass.). Exptl. Cell Res., 30: 23-35(Mar. 1963).

Inseminated eggs of Arbacia punctulata were immersed at various times in artificial sea water containing 70 to 90 per cent D_2O. Subsequently the effects were analyzed by pressure-centrifugation and by isolation of the mitotic apparatus, using the ethanol-digitonin method. The D_2O treatments exert a stabilizing action upon the nuclear membrane and upon various gel structures, i.e., the aster, the spindle and the peripheral plasmagel layer of the cytoplasm. Prophase and metaphase eggs, placed in 80 per cent D_2O sea water, remain frozen in their initial state for at least 30 min as judged by mitotic apparatus isolations made during and at the end of such an immersion period. The gel structure of the peripheral cytoplasm becomes definitely firmer. Gel strength measurements, made at 20°C by the pressure-centrifuge method, gave values which consistently were about 24 per cent higher than normal. However, the slope of gel strength–pressure curve for D_2O treated eggs was the same as that of untreated controls. Although the structure of the peripheral plasmagel layer was changed, the furrowing capacity of the eggs was not abolished by the D_2O treatment. The anti-mitotic effects of the heavy water were interpreted in terms of changes in the chemical bonding of gel structures. (auth)

26976 STUDIES ON THE EXCLUSIVE PERCUTANEOUS IRRADIATION OF CERVICAL CARCINOMA BY TELECOBALT. Rolf Frischkorn (Universitaets-Frauenklinik, Goettingen, Ger.). Geburtsh. Frauenheilk., 23: 117-30 (Feb. 1963).

Dosimetry studies were conducted preliminary to the use of a method employing Co^{60} external irradiation without internal implantation of Ra for the treatment of cancer of the uterine cervix. Because of the high depth doses now possible with Co^{60} therapy, it is suggested that Ra treatment can be eliminated. Isodose diagrams were prepared by use of a paraffin phantom to simulate abdominal structures. The diagrams are illustrated for various combination of fields of irradiation. Techniques for localizing the tumor for proper orientation of the patient in the fields are also described. (H.H.D.)

26977 FURTHER DATA ON THE OVERDOMINANCE OF INDUCED MUTATIONS. Bruce Wallace (Cornell Univ., Ithaca, N. Y.). Genetics, 48: 633-51(May 1963).

A preliminary analysis is presented of the viability effects of new mutations in heterozygous condition in three sorts of second-chromosome backgrounds: homozygous for chromosomes obtained from large populations, heterozygous for two chromosomes obtained from the same population, and heterozygous for two chromosomes obtained from widely separated populations of Drosophila melanogaster. The data are inconclusive, but in several types of analyses are consistent with the following suggestion: If a_i and a_j are two of many alleles at a locus retained in a large population under the influence of natural selection, and if a_* is a newly induced allele, the order of viability of the different genotypes is $a_i/a_j > a_i/a_* > a_i/a_i$ on the average. (auth)

26978 HETEROCARYOSIS AND THE PARASEXUAL CYCLE IN ASPERGILLUS FUMIGATUS. Oeistein Stroemnaes and E. D. Garber (Univ. of Oslo, Blindern, Norway and Univ. of Chicago). Genetics, 48: 653-62(May 1963).

Twenty-seven haploid strains differing in color and nutritional requirements of the imperfect fungus Aspergillus fumigatus were involved in 51 heterocaryons. Color mutants were assigned to 12 loci; two allelic series, each with two mutants, were detected. The medium on which heterocaryons were grown and the combination of haploid strains appeared to determine the frequency of diploid conidia. Thirty-seven diploid strains were obtained and, of 36 strains, 25 were unstable in that they yielded haploid segregants. Although parental and certain recombinant genotypes usually occurred among haploid segregants from 17 diploid strains, the frequency of parental genotypes was generally lower than that of prototrophic recombinants. Twenty-three of 26 genetic markers could not be assigned to linkage groups. The absence of detectable linkages was attributed to nuclear selection of haploid segregants with certain genotypes in the haploid-diploid mycelium. Three alternate explanations were briefly discussed. A survey of published data on the frequency of haploid segregants from diploid strains of 11 taxa of filamentous fungi indicated that linkage was not detected in six taxa. (auth)

26979 THE GENETIC CONTROL OF MATING TYPE DIFFERENTIATION IN PARAMECIUM. Stephan R. Taub (Harvard Univ., Cambridge, Mass.). Genetics, 48: 815-34 (June 1963).

Within wild-type stocks of syngen 7 of Paramecium aurelia, a high positive correlation in mating type occurs between sister caryonides and between parent and cytoplasmic progeny. On the basis of these observations, syngen 7 is classified into group B. Two mutations are described which affect mating type determination in this syngen. The first, designated mt^{XIII}, has a recessive effect causing homozygotes to become type XIII regardless of the mating type-determining state of the cytoplasm received from the previous generation. The second mutation, designated n, has an identical effect. The wild-type alleles of these mutations, designated $mt^{XIII,XIV}$ and N, respectively, permit the expression of either mating type XIII or XIV, which one depending on the kind of cytoplasm transmitted by the previous generation. In addition to its effect on mating type potentialities, the mt^{XIII} gene has a second effect which causes a carrier's cytoplasm to be type XIV-determining regardless of its mating type. mt^{XIII} is dominant to $mt^{XIII,XIV}$ for this effect. The mt^{XIII} gene was found in a stock collected from nature; the n mutation arose following ultraviolet irradiation of wild-type cells. mt^{XIII} and n are at separate, unlinked loci. (auth)

26980 GALACTOSE MUTATIONS OF ESCHERICHIA COLI K-12 NOT AMENABLE TO LAMBDA TRANSDUCTION. M. L. Morse (Univ. of Colorado, Denver). Genetics, 48: 834-40(June 1963).

Four galactose mutants not amenable to lambda transduction were analyzed genetically and biochemically. Two of the mutants, and possibly a third, are double mutants for a gene in the Gal operon and for a gene whose function was not identified. The fourth mutant did not have a defect in kinase, transferase, or epimerase, and must therefore have a genetic lesion outside the Gal operon. The gene not

identified may be for the enzyme pyrophosphorylase. This gene is not transduced by lambda. (auth)

26981 THE GLUTAMATE ISOMERASE REACTION: STUDIES ON THE INCORPORATION OF SOLVENT HYDROGEN. A. A. Iodice and H. A. Barker (Univ. of California, Berkeley). J. Biol. Chem., 238: 2094-7(June 1963).

The source of the hydrogen atom that is transferred between the β-carbon of glutamate and the methyl carbon of β-methylaspartate in the glutamate isomerase reaction was studied by carrying out the coupled isomerase and β-methylaspartase reactions in the presence of tritium- or deuterium-labeled water. In the decomposition of glutamate only about 0.1 atom of hydrogen from the solvent was incorporated per mole of mesaconate formed, and this small amount can be attributed to side reactions. In the synthesis of β-methylaspartate from mesaconate and ammonia, approximately 1 mole of solvent hydrogen is incorporated, whereas in the conversion of β-methylaspartate to glutamate no more hydrogen is taken up. The results indicate that a free proton is not involved in the glutamate isomerase reaction. (auth)

26982 THE CONVERSION OF THYMIDINE TO THYMINE NUCLEOTIDES AND DEOXYRIBONUCLEIC ACID IN VIVO. Richard L. Potter and Oddvar F. Nygaard (Univ. of Michigan, Ann Arbor). J. Biol. Chem., 238: 2150-5(June 1963).

The conversion of thymidine-2-C^{14} to thymine nucleotides and DNA-thymidylic acid was studied in spleen and thymus of the rat in vivo. In the spleen the specific activity-time curves for the various thymidine derivatives were compatible with the scheme

$$\text{Thymidine} \rightarrow \text{dTMP} \rightarrow [\text{dTDP} \rightleftharpoons \text{dTTP}] \rightarrow \text{DNA-thymidylic acid}$$
$$\qquad\qquad\qquad\quad \nearrow \text{X}$$

where X represents endogenous precursors of thymidine 5'-phosphate (dTMP) other than thymidine. As the result of a very rapid equilibration of radioactivity between thymidine 5'-diphosphate (dTDP) and thymidine 5'-triphosphate (dTTP), the metabolic interrelationship of these two compounds could not be assessed from the data obtained and, furthermore, from the point of view of tracer kinetics, either compound could equally well satisfy the requirements for an immediate precursor of DNA-thymidylic acid. The present data permit no conclusion, therefore, as to the possible identity of the mechanisms of DNA synthesis in vivo and in vitro. In the thymus, the situation is further complicated by what appears to be the presence of large heterogeneous pools of thymine nucleotides, some of which do not readily equilibrate with the injected radioactive thymidine. The over-all pool sizes of the different thymidine derivatives in both organs were established. Calculations showed that if thymidine 5'-triphosphate were indeed the immediate precursor of DNA-thymidylic acid in vivo, the pools of this compound must turn over at least twice every minute in those cells of either tissue in which DNA is undergoing replication. (auth)

26983 KINETIC STUDIES ON HYDROGENASE. Nobuo Tamiya and Stanley L. Miller (Columbia Univ., New York). J. Biol. Chem., 238: 2194-8(June 1963).

The kinetics of hydrogenase from Clostridium pasteurianum and from Proteus vulgaris were studied by measuring the HD and D_2 produced when the enzyme catalyzes the exchange between H_2 and 100% D_2O. The ratio of D_2 to HD production depends on the enzyme concentration because the HD produced by the exchange of H_2 can react with another enzyme molecule to give D_2 before it enters the gas phase. At very low enzyme concentrations the ratio D_2/HD is independent of the enzyme concentration. The D_2/HD ratio depends on pH. For the hydrogenase from Clostridium pasteurianum this ratio is a maximum at a pH of 7.5, whereas the maximum in the enzyme activity occurs at a pH of 8.3. The rate of conversion of p- to o-hydrogen in pure D_2O was measured and found to be less than $^1/_{10}$ the rate of the exchange reaction. The ratio D_2 to HD production and the rate of conversion of p-hydrogen are calculated for three types of activation of the H_2: a homolytic cleavage of the H_2 into two hydrogen atoms bound to the enzyme; a cleavage of the H_2 into an enzyme hydride and a proton, with the hydride not exchanging with the solvent; and, a cleavage of the H_2 into an enzyme hydride and a proton, but with the hydride able to exchange with the solvent. The experimental data are consistent with the cleavage of the H_2 into a proton and an enzyme hydride that can exchange with the solvent. It is also possible to interpret these data in terms of a hydride that does not exchange, if it is assumed that there is a cage of water molecules or protein around the active site which allows the H_2 molecule to react several times before it leaves the vicinity of the enzyme. (auth)

26984 RE-EVALUATION OF THE I^{131}-TRIOLEIN ABSORPTION TEST. ANALYSIS AND PURIFICATION OF COMMERCIAL RADIOIODINATED TRIOLEIN AND CLINICAL STUDIES WITH PURE PREPARATIONS. Naip Tuna, Helmut K. Mangold, and Donn G. Mosser (Univ. of Minnesota, Minneapolis). J. Lab. Clin. Med., 61: 620-8(Apr. 1963).

Five widely used commercial preparations of radioiodinated triolein were chromatographically analyzed for radiochemical purity. It was found that only 30 to 60 per cent of the radioactivity was in triglycerides. Remaining radioactivity was distributed among free fatty acids, their methyl esters, partially digested fats, acetoglycerides, and other substances. Fat absorption studies in 5 normal persons showed that both the purified and the commercial preparation were absorbed in considerable amounts. The absorption of purified radiotriolein was, however, less than that of the commercial preparations. In 4 patients with fat malabsorption syndrome, 3 with idiopathic steatorrhea, and 1 with terminal ileitis, the commercial preparation showed normal fat absorption whereas pure radioiodinated triglycerides were not appreciably absorbed in any of the cases. It is concluded that absorption of pure triolein is less than the I^{131}-triolein absorption when the test is done with commercial preparations. This would indicate that a substantial percentage of blood radioactivity in the latter test is related to substances other than triolein. Although in 4 patients with fat malabsorption the purified radiotriolein absorption test agreed better with the clinical and the chemical fecal fat studies, its value should be determined on a larger number of patients and normal controls. Chromatographic methods are described for the rapid analysis of commercial radioiodinated triolein preparations and for their purification. (auth)

26985 NEW IN VIVO TRACER METHOD WITH THE USE OF NONRADIOACTIVE ISOTOPES AND ACTIVATION ANALYSIS. James T. Lowman and William Krivit (Univ. of Minnesota, Minneapolis). J. Lab. Clin. Med., 61: 1042-8(June 1963).

A method that uses stable, nonradioactive isotopes as tracers has been developed which is suitable for metabolic studies in newborn infants and pregnant women. The stable

tracer is injected, and the samples recovered are activated with thermal neutrons. The isotopes produced are identified and quantitated with their specific emission patterns. Stable Fe^{58}, as an example, becomes Fe^{59} following neutron activation. Standard recovery studies of tracer concentrations of Fe^{58} show reproducible, quantitative results. Simultaneous Fe^{58} and Fe^{59} in vivo plasma clearance studies reveal identical utilization of these isotopes. This technique has potentially broad application in the area of human in vivo kinetic tracer studies. (auth)

26986 ROENTGEN DIAGNOSIS OF THE UPPER GASTROINTESTINAL TRACT: HISTORICAL DEVELOPMENT: THE KIRKLIN-WEBER LECTURE. Leo G. Rigler (Cedars of Lebanon Hospital, Los Angeles, Calif.). J. Lancet, 82: 293-300(July 1962).

Developments in the use of x rays in gastroenterology from their discovery in 1895 to the present are reviewed. (H.H.D.)

26987 STUDIES ON THE MECHANISM OF IMMUNOLOGICAL ENHANCEMENT OF TUMOR HOMOGRAFTS. III. INTERACTION BETWEEN HUMORAL ISOANTIBODIES AND IMMUNE LYMPHOID CELLS. Goeran Moeller (Karolinska Inst., Stockholm). J. Natl. Cancer Inst., 30: 1205-26(June 1963).

Immunological enhancement was studied specifically to demonstrate the possible occurrence of efferent inhibition of transplantation immunity caused by humoral antibodies. Enhancement could be induced in preimmunized foreign recipients by treatment of tumor cells with antibodies in vitro before their inoculation. Tumor cells coated with humoral isoantibodies had a lower capacity to absorb antibodies of the same specificity than untreated cells, as their antigenic receptors seemed partially blocked and could no longer react with antibodies. Passive transfer of humoral antibodies into preimmunized recipients prevented an efficient secondary response. The experiments suggested that enhanced growth of antiserum-treated tumor cells in preimmunized recipients may be caused by a dual effect of antibodies, an afferent inhibition of transplantation immunity inhibiting the development of the secondary response and an efferent suppression of the homograft reaction protecting the tumor cells from destruction by the immune effector mechanisms. The protective effect of antibodies was studied. Tumor cells were mixed with antibodies and immune lymphoid cells and inoculated into foreign hosts or recipients which were compatible with the tumor cells and lymphoid cells. Antibodies antagonized the neutralizing effect of immune lymphoid cells efficiently in foreign recipients, caused partly by inhibition of the homograft reaction of the host itself and partly by protection of the tumor cells. Protection by humoral antibodies was also demonstrated in compatible recipients and, since the homograft reaction could not interfere, the effect of antibodies could be ascribed exclusively to efferent inhibition of transplantation immunity. (auth)

26988 A SIMPLE PROCEDURE FOR THE DESTAINING OF STRIPPING-FILM RADIOAUTOGRAPHS. Renata Baserga and Dorothy Banks (Northwestern Univ., Chicago). J. Pathol. Bacteriol., 84: 239-41(July 1962).

Trypsin digestion of stripping-film radioautographs after photographic processing and staining removes the excess gelatin without affecting the intensity of the radioautograph, and results in a thin colorless emulsion that makes microscopic observation and photography easier. Methanol-fixed smears or Carnoy-fixed tissue sections, labeled with tritiated thymidine and unstained, were radioautographed, and the radioautographs were developed, fixed, stained with hematoxylin, and counterstained with eosin. The slides were air-dried, rehydrated for 10 min in distilled water, and incubated in a 0.01% solution of trypsin at 37°C for 6-8 min. In stripping-film radioautographs digested as described, the 10 μ supporting layer of gelatin is completely removed, but the sensitized layer containing the developed silver grains is not affected. (H.H.D.)

26989 PRESENT STATUS OF RADIATION THERAPY OF MALIGNANT DISEASE. James E. Coyle (Wayne State Univ., Detroit). Laryngoscope, 72: 488-507(Apr. 1962).

Reviews are presented on: historical development of radiotherapy, radiobiology, factors influencing radiation response, and newer developments in radiotherapy techniques. (H.H.D.)

26990 CHEMO-RADIOTHERAPY COMBINATIONS. G. Meldolesi (Università, Catania, Italy). Laval Med., 34: 134-6(Jan. 1963). (In French)

From Symposium on Radiosensitivity, Laval Univ., Quebec, Sept. 1962.

Fundamental and practical clinical aspects of combined use of x rays and antimitotic drugs are discussed. Antiblastic chemotherapeutic drugs have a general action on the organism that is always a more or less toxic one, thereby limiting their use to very low doses. No decisive favorable effect could be obtained under these conditions. It is suggested that combined treatment be established in cases of seemingly early neoplasms, where malignant cells are found in the blood, giving a high probability of metastases. Surgical removal of the tumor or radium application should be preceded by chemotherapy and followed by conventional or high voltage radiotherapy. Afterwards, repeated chemotherapeutic or radiotherapeutic series are indicated. Bone-marrow depletion caused by these treatments should be dealt with by medullary autografts and repeated blood transfusions if indicated. Metastases should also be treated by combined chemo-radiotherapy. It is however necessary to determine the most efficient method of treatment. The optimum order in which the various treatments should be given still remains to be established. It should be possible to give a course of radiotherapy at a time when the radiosensitivity ratio between the neoplasm and the surrounding tissues is highest. (H.H.D.)

26991 A NEW SOFT-RAY TUBE FOR ROENTGEN THERAPY OF HEMANGIOMAS. Richard Schmitz. Med. Welt, 31: 1566-8(Aug. 5, 1961).

An adapter for an x-ray tube, consisting of a lead-glass sleeve and a perforated plastic filter, is described and illustrated. The adapter is used for the treatment of benign skin disorders, particularly cavernous hemangiomas, in order to give a relatively high surface dose to a circumscribed area. Use of the device in the treatment of 30 patients is discussed. (H.H.D.)

26992 NEW INDICATOR METHODOLOGY FOR DIAGNOSIS OF TUMORS BY MEANS OF RADIOISOTOPES. G. Monasterio, M. F. Becchini, and R. Giordani (Università, Pisa, Italy). Minerva Nucl., 7: 115-23(Apr. 1963). (In Italian)

Sodium radioiodide (Na-I^{131}) and I^{131}-labeled human fibrogen (RIHF), polyvinylpyrrolidone (PVP), human serum albumin (RIHSA), and diiodofluorescein (DIF) were injected into experimental tumor-bearing rats (cloromyeloma) and into rats with an inflammatory process due to local burning. The radioiodine uptake by both types of lesions was measured in vivo and in vitro, after sacrifice of the animals, and

compared with uptake by normal homologous tissues. Na-I^{131} and D-I^{131}F were rapidly concentrated in both lesions, but no detectable difference from the normal tissues was observed 24 hr after injection. Similar behavior showed R-I^{131}HF, R-I^{131}HSA, and PVP-I^{131} in the inflammatory processes, while they were progressively concentrated in the tumors, the maximum being reached 24 hr after injection. The same indicators were tested in patients with known tumors of inflammatory processes of the lungs. R-I^{131}HSA yielded 82% of correct results in 56 cases with brain tumors, while no significant results were obtained in other types of tumors. D-I^{131}F gave correct results in all the tumors localized in the limbs and salivary glands, while tumors located in other areas were not detected. Very encouraging results were obtained in a small group of brain tumors (9 cases) using PVP-I^{131}. R-I^{131}HF was used in 24 tumors of various organs and in 6 cases of localized lung inflammatory process yielded negative results. The percentage of correct diagnosis with R-I^{131}HF in lesions not localized along the midline was 70%. It was concluded that R-I^{131}HF and PVP-I^{131} appear to be useful indicators for the early detection of tumors in organs in which other indicators have proved unsuccessful. (auth)

26993 DIAGNOSIS AND STUDIES OF THYROID TUMORS WITH THE AID OF RADIOIODINE. E. E. Pochin (University Coll., London). Minerva Nucl., 7: 124-7(Apr. 1963). (In Italian)

A review is presented on the use of I^{131} for the study and diagnosis of thyroid tumors. It was concluded that the value of I^{131} is rather poor in the early diagnosis of cancer of the thyroid. Reasons for this are discussed. (P.C.H.)

26994 RADIOISOTOPIC METHODS IN THE DIAGNOSIS OF INTRACRANIAL TUMORS. P. E. Maspes, P. Paoletti, and R. Villani (Università, Milan). Minerva Nucl., 7: 127-34(Apr. 1963). (In Italian)

A review is presented on the diagnosis of intracranial tumors by radioisotopic techniques, and the results obtained in 110 cases using radioiodinated albumin and the Planiol manual method for the measurement of radioactivity are reported. The cases were divided into two groups. The first group included 25 intracranial tumors of various types, 7 normal controls, and 10 cases of vascular or other diseases of the central nervous system. 14 of the 28 cases of tumors were localized exactly. In 4 cases it could be established whether the tumor was situated on the left or right side, and in 10 cases multiple or incorrect localization were obtained. The second group of cases included 37 cases of metastases and 28 hemispheric or middle-line tumors. 59% of the 37 cases of metastases investigated were localized exactly, in 4% an incorrect localization was obtained, and in 37% the gamma encephalographic diagnosis could not be controlled. 54% of cases showed multiple localizations. The results are discussed and the advantages of gamma encephalography in the diagnosis of metastases is stressed. The value of Van der Werff's method for the diagnosis of tumors of the middle line is discussed and illustrated. (auth)

26995 THE DIAGNOSIS OF FEMALE GENITAL TUMORS WITH RADIOISOTOPES. G. Paroli, A. Zacutti, G. Turchetti, and M. F. Becchini (Università, Pisa, Italy). Minerva Nucl., 7: 135-42(Apr. 1963). (In Italian)

The use of radioactive tracer substances for demonstrating the early stages of tumors of the genital organs is considered. As regards the external genital organs, patients with acute or chronic vulvitis, kraurosis vulvar with or without leukoplakia, and cancer were examined by measuring the radioactivity with a Geiger-Müller counter 6, 24, and 48 hr after the injection of 3 C of P^{32} per kg of body weight. The results indicate that investigation of the uptake of radiophorphorus in the vulva can yield valuable information as to the nature of the various conditions considered. Measurements were made with a Geiger-Müller probe counter over the portio in normal cases and in patients with different types of disease (erosions, polyps, cancer) at various intervals after the injection of the same dose of P^{32} intravenously. It was shown that a high uptake can be demonstrated in vivo in the neoplastic tissues as compared with the normal tissues. The difference is most significant between the 48th and 72nd hr, when the values measured over erosions and polyps remain within the range of normal. The method therefore makes it possible to identify areas of neoplastic tissue in the portio and to establish their boundaries faily well. The uptake of P^{32} was investigated in cases of cancer of the neck of the uterus before and after radium therapy. It was found that the method is valuable in establishing the prognosis and as a method for controlling the effects of irradiation. Finally, the results obtained in the field of the diagnosis of ovarian tumors with the use of gamma-emitting tracer substances (radioiodinated human serum albumin and I^{131}-labeled diiodofluorescein) and those of intra-operative investigation of lymph nodes containing metastases in cases of cancer of the cervix after the administration of P^{32} are presented. The importance of the method, especially as regards the possibilities of completely removing all lymph nodes involved by the tumor, is discussed. (auth)

26996 POSSIBILITY OF SCINTIGRAPHY IN THE STUDY OF METASTASES OF THYROID ADENOCARCINOMA. I. Baschieri, P. Pavoni, L. Semprebene, and G. A. Benedetti (Università, Rome). Minerva Nucl., 7: 143-9 (Apr. 1963). (In Italian)

The possibility of studying metastases of thyroid adenocarcinoma by means of scintillation scanning was examined. The possibility is related especially to the power of the heteroplastic tissue to absorb the reactive elements in considerable concentrations. On the basis of experimental phantom studies, the minimum concentration of radioactive elements and the minimum size of a metastasis capable of being revealed by simple scintillation scanning and combined scintillation scanning are defined. The latter technique makes it possible to achieve more accurate counting even with deeply placed radiation sources, and to determine fairly accurately the site of the metastatic focus on the anteroposterior axis of the body. A number of interesting clinical examples of the methods, used in a large number of personally observed cases, are illustrated. (auth)

26997 THE USE OF GAMMA ENCEPHALOGRAPHY IN THE DIAGNOSIS OF CEREBRAL LESIONS. C. Mastropaolo and T. Dacquino (Università, Genoa). Minerva Nucl., 7: 153-7(Apr. 1963). (In Italian)

The criteria for considering a gamma encephalographic tracing positive are explained and the various forms of positive tracings are illustrated. Gamma encephalographic findings obtained are correlated with the nature, site, and extent of the lesion and (with regard to vascular lesions) also the interval between the acute episode and encephalographic examination. A series of cases subjected to about 200 gamma encephalographic examinations is presented. Space-occupying and vascular cerebral lesions, epileptic syndromes, and various types of cerebral lesions are included in the series. On the basis of the findings obtained, the usefulness of gamma encephalography in the diagnosis of cerebral lesions is discussed. (auth)

26998 PULMONARY METASTASES FROM THYROID CARCINOMA. A. Torsoli, I. Baschieri, P. Pavoni, and G. de Maio (Università, Rome). Minerva Nucl., 7: 157-62 (Apr. 1963). (In Italian)

Fourteen cases of thyroid carcinoma with pulmonary metastases are presented. Reference is made to the frequency of the metastatic alterations compared with extrapulmonary metastases demonstrated in the same patients. Examination was carried out by means of radiology and scintillation scanning. The findings suggest that: in cases of functioning pulmonary metastases scintillation scanning provides earlier evidence than radiography. A negative radiographic investigation does not rule out the existence of metastases. A positive radiographic finding may be invalidated by a concealed iodine uptake capacity in the metastases, which appear to be inactive because of their histological nature or because of an as yet insufficient thyrotrophin stimulation. Metastatic alterations possess different radiomorphological features. Of particular practical interest are certain early radiographic pictures that correspond to scintillation scanning signs of extensive pulmonary involvement. A comparison between the findings of radiography and scintillation counting is particularly useful for assessing the subsequent development of the lesion. (auth)

26999 THOROTRAST GRANULOMA WITH RECURRENT NERVE PARALYSIS, 18 YEARS AFTER ARTERIOGRAPHY. J. Kuilman. Ned. Tijdschr. Geneesk., 106: 401-2(Feb. 24, 1962).

A history is described of a patient who developed a benign tumor as a result of earlier arterial injection of ThO_2 as a contrast medium. (H.H.D.)

27000 MEGAVOLT THERAPY AND THE CANCER PATIENT. B. Verbeeten (Radiotherapeutisch Instituut, Tilburg, Netherlands). Ned. Tijdschr. Geneesk., 106: 2423-5(Dec. 1, 1962).

The relative advantages of megavolt x-ray therapy, as compared with conventional 250-kv therapy for destroying cancer cells are recounted. (H.H.D.)

27001 THE PERFORMANCE OF A GAMMA CAMERA FOR THE VISUALIZATION OF RADIOACTIVE ISOTOPES IN VIVO. J. R. Mallard and M. J. Myers (Hammersmith Hospital, London). Phys. Med. Biol., 8: 165-82(June 1963).

A prototype gamma camera for visualizing the distribution of radioactivity in vivo was investigated and improved. Performance figures are given for each parameter to serve as a guide for practical applications and future development of the instrument. The camera differs from that of Anger mainly in that the display is presented on a storage tube. Some advantages of this method of display are given. (auth)

27002 CLINICAL APPLICATIONS OF A GAMMA CAMERA. J. R. Mallard and M. J. Myers (Hammersmith Hospital, London). Phys. Med. Biol., 8, 183-92(June 1963).

A gamma camera was used for thyroid, brain, and kidney scanning and its immediate and potential uses after further modifications are discussed. The camera was used with a collimating grid instead of a pinhole and preliminary results with it are reported. It is concluded that the gamma camera can be used successfully for the majority of present-day radioactive-isotope scanning techniques, with the limitations that the display is small and to some extent distorted. These disadvantages are minimal in thyroid scanning. The machine will enable dynamic events to be studied and short-lived isotopes to be used, neither of which are practicable with mechanical scanning machines. (auth)

27003 THE PRESENT STATUS OF SUPERVOLTAGE RADIATION THERAPY. J. W. J. Carpender and T. C. Chang (Univ. of Chicago and Radiation Therapy Training Center, Taiwan, China). Postgrad. Med., 32: A67-71(Nov. 1962).

The relative advantages of supervoltage (>1 Mev) over orthovoltage (<1 Mev) therapy are discussed. Employment of higher voltage devices is not advocated with the expectation that the ionizing radiation they produce is more effective against cancer cells than 250-kv x rays. On the contrary, the reverse is true and, for a given physical dose, 250-kv x rays are more effective than those produced at significantly higher voltages. Their advantages on 5 specific phenomena are: depth dose; so-called skin sparing; so-called bone sparing; relative absorption in air-containing lung; and the general sense of well-being experienced by patients having super-voltage radiation therapy. It is suggested that the true value of supervoltage is ~90%, and it is recommended that physical doses of supervoltage radiation ~10% larger than those calculated for orthovoltage be given. Supervoltage frequently allows treatment through a single large port in cases where orthovoltage would require cross-firing through multiple small ports. Large single ports simplify the planning and execution of irradiation and are particularly useful when the objective is palliation. At supervoltages, bone and soft tissue absorb radiation equally, thus overcoming both disadvantages of orthovoltage. It was concluded that although supervoltage involves risks, they can be guarded against, and although its advantages are small they are, nevertheless, worthwhile. (TCO)

27004 IRRADIATED DIETS FOR REARING GERM-FREE GUINEA PIGS. Richard E. Horton and John L. S. Hickey (National Inst. of Allergy and Infectious Diseases, Bethesda, Md.). Proc. Animal Care Panel, 11: 93-106 (Apr. 1961).

Because of the destruction of some vitamins, especially thiamin and ascorbic acid, during steam sterilization of diets, studies were conducted on sterilization by high-speed electrons. Complete rations for rearing germfree guinea pigs were sterilized successfully by a dose as low as 2 megarad from a Van de Graaf electron beam accelerator. While conventional guinea pigs maintained on a natural diet sterilized at 3 megarad grew reasonably well and reproduced satisfactorily, the same diet failed to provide the necessary nutritional requirements for rearing germfree animals. A semisynthetic ration sterilized at 2 megarad produced germfree animals of good quality as regards early growth and general physical condition. The fact that conventional animals receiving the sterilized semisynthetic diet grew at a faster rate suggests that unidentified or additional growth factors are contributed by the action of the intestinal microflora. The problem remains whether these can be identified and furnished by a sterilized synthetic diet. Additional studies will be required before the diet can be evaluated for its adequacy to support reproduction and subsequent generations of germfree animals. There was little difference in the weight of the cecum between the 2 groups, although in the conventional animals it weighed slightly more. The weight of the contents of the cecum was somewhat higher in the germfree group, constituting 8.8% of body weight, compared with 5.8% for conventional animals. The hemoglobin and hematocrit values were essentially the same for both groups, but fewer white cells were observed in the germfree group. A technique using 3% peracetic acid as a germicide is also described for transferring sterile diets to the germfree enclosures. The conven-

ience of handling the radiation–sterilized diet, once it has been transferred to the germfree system, seems to outweigh some of the disadvantages associated with monitoring the sterilization process. With the necessary modifications, other sources of irradiation can be employed in a similar fashion to sterilize complete or basic diets for the same or other germfree species. (H.H.D.)

27005 THE IMPACT OF ATOMIC ENERGY ON BIOLOGY AND MEDICINE. F. C. Nachod (Sterling-Winthrop Research Inst., Rensselaer, N. Y.). Proc. Rudolf Virchow Med. Soc. City N. Y., 20: 76-81(1961).

Outstanding advances made from 1951 to 1961 are discussed, particularly with regard to the use of radioisotopes as tracers in biochemical experiments and for diagnostic and therapeutic techniques. The following diagnostic applications are considered: measurement of myocardial blood flow; localization of tumors; liver and kidney function tests; and vitamin B_{12} absorption. Of the armament of artificially produced radioelements, several hundred in number, only about a dozen promises to be useful in medical applications. This small number is predicated by reasons of toxicity on one hand and of useful half life on the other. (H.H.D.)

27006 THE SUPRA-MAMMARY LOCALIZATION OF BREAST CANCER. TREATMENT AND RESULTS. F. Baclesse. Radiol. Clin., 32: 349-52(1963). (In French)

Of 1019 cases of breast cancer, treated from 1936 to 1955, there were 10 cases (0.98%) of supra-mammary lesions, 5 were treated with x-ray therapy alone, 3 with mastectomy followed by high-dose radiotherapy, and 2 with preoperative x-ray therapy followed by radical mastectomy. 8 patients survived 5 years in good condition, but 1 had a bone metastasis in the 6th year. 2 patients survived in apparently good condition 14 and 21 years. 1 patient was lost sight of, and counted as failure. 1 patient with bilateral tumor died rapidly of generalized metastases. All treatments were with 200 kv, and 1 mm Cu filter; fractionated, generally, over 3 months. (auth)

27007 ON THE QUESTION OF SURGICAL-RADIOLOGICAL TREATMENT OF LUNG CARCINOMAS. E. Endrei and R. Fridrich (Universität, Basel). Radiol. Clin., 32: 353-9(1963). (In German)

It was concluded that, on a limited number of cases, pneumonectomy followed by rotational radiotherapy of the hilar and regional area appears to offer the best chances in bronchial carcinoma. If a pneumonectomy cannot be carried out, a partial resection should be done. However, no evidence was found of the value of postoperative radiotherapy after lobectomy. (auth)

27008 THE Co^{60} OSCILLATING IRRADIATION WITH PROGREDIENT FILTERING. H. Etter (Kantonsspitals, Lucerne, Switzerland). Radiol. Clin., 32: 393-7(1963). (In German)

A shutter-type lead filter is shown for above table oscillation; it is fixed to the two oscillating sides of the radiation outlet with a hinge. As the machine swings, the outlet is thus narrowed from the top downwards and a migration of the maximum dose towards the turning point prevented. The length of the lead plates and the distance between them are adjustable according to the size of the field. (auth)

27009 THE VOLUME DOSE IN Co^{60} THERAPY. H. Etter (Kantonsspitals Lucerne, Switzerland). Radiol. Clin., 32: 398-401(1963). (In German)

For foci near the surface, the lowest volume dose was obtained with 200-kv radiation, and for deeper foci with Co^{60} counter-field radiation at the shortest diameter. As this gives a higher skin than tumor dose, the tolerance limit is determined by the skin. In order to obtain the remaining tumor dose required, multifield or oscillating radiation must be used. (auth)

27010 THE USE OF STANDARD SLIDES IN SEMI-QUANTITATIVE RADIOAUTOGRAPHY WITH TRITIATED COMPOUNDS. Renato Baserga and Ken Nemeroff (Northwestern Univ., Chicago). Stain Technol., 38: 111-16(Mar. 1963).

By use of the "standard-slide" method it is possible to determine if different batches of radioautographs, or even different radioautographs in the same batch, have been processed in an identical manner, and if not, what corrections are necessary to obtain a valid comparison between different radioautographs. With the technique described, essentially identical smears can be prepared from a pooled suspension of Ehrlich ascites tumor cells labeled with tritiated thymidine. In these smears, the percentage of labeled cells and the mean grain count per labeled cell vary within marrow limits; in a given slide, within 2 to 5% of the mean of the slide. In smears processed together in the same manner, the percentage of labeled cells (calculated on 1000 cells) varies within 2%, and the mean grain count per labeled cell (calculated on 50 cells) between 15 and 20% of the mean of all smears. Once the limits of variability are known, smears from the same cell population can be used to ensure the accuracy of procedures performed on separate batches of radioautographs that have been processed separately but in a presumably identical manner. A comparison of the mean grain counts of standard smears from separate batches indicates if variations have occurred during the radioautographic procedure. Any tritiated compound may be used to prepare standard slides. (H.H.D.)

27011 THE USE OF IONIZING RADIATION FOR FOOD PRESERVATION. P. Mauranges. Therap. Semaine Hop., 37: 254-7(Mar. 1961).

Principles of the method and some practical applications are discussed. (H.H.D.)

27012 TREATMENT OF GENITAL CARCINOMA AT THE GYNECOLOGIC CLINIC OF THE UNIVERSITY OF BERLIN AFTER THE INTRODUCTION OF IONIZING RADIATION INTO THERAPY. IIA. THE THERAPY OF GENITAL CARCONOMA FROM 1910 TO 1950. W. Janisch-Raskovic (Humboldt Universität, Berlin). Z. Aerztl. Fortbild., 56: 191-7(Feb. 1, 1962).

A historical review on the use of radiation in the treatment of gynecologic cancer is presented. (H.H.D.)

Biochemistry, Nutrition, and Toxicology

27013 (TID-18878) RECENT MEASUREMENTS OF GAMMA EMITTING RADIONUCLIDES IN NEWBORNS, INFANTS AND CHILDREN. N. S. MacDonald, D. L. Hutchinson, D. L. Moyer, and R. A. Chez (California. Univ., Los Angeles. School of Medicine. Lab. of Nuclear Medicine and Radiation Biology). [June 14, 1963]. Contract AT(04-1)-Gen-12. 15p.

Twenty-eight newborn infants, 7 stillborns, and 21 children from 4 to 15 years of age were examined for γ activity in a low background, high sensitivity total-body counting facility. The latter group all contained traces of Zr^{95}–Nb^{95}, $Ru^{103,106}$, and Cs^{137} in addition to the normal K^{40}. The greatest concentration of Cs^{137} observed was 0.8×10^{-10} C/kg body weight, or about 4% of the natural

K^{40} activity. Burdens of the other γ-emitting radioisotope were less. Newborns contained no activity other than K^{40} detectable in 45 min counting time. Four of the 7 stillborns, each counted for 10 hr, showed K^{40} and traces of Zr^{95}, Nb^{95}, and $Ru^{103,106}$. The Zr^{95}:Nb^{95} ratios were lower in the infants than in their placentas suggesting placental discrimination against Zr^{95}. The Cs^{137}:K^{40} ratios were lower in infants than in children or adults. Twenty-four infant thyroid glands obtained at autopsy contained no detectable radioiodine (less than 0.3×10^{-10} C). (auth)

27014 GAMMA-RAY SPECTROMETRIC ANALYSIS OF SOME MICRO ELEMENTS IN HUMAN MANDIBULAR COMPACT BONE. Rune Soeremark and Bo Bergman (Royal School of Dentistry, Stockholm). Acta Isotopica, 2: 5-19 (1962). (In English)

By means of neutron activation and gamma-ray spectrometry the concentrations in compact human mandibular bone of the following elements were determined: Na, Ca, Mn, Cu, Zn, Sr, Rb, Cd, W, and Au. The bone samples were obtained from postmortem material, five men and five women, ranging in age from 56 to 79 years. The neutron activation was carried out in a flux of about 1.7×10^{12} neutrons × cm^{-2} × $sec.^{-1}$ for about 20 hours. The gamma-ray spectrometry was preceded by a chemical group separation. (auth)

27015 Fe^{59} ERYTHROCYTE INCORPORATION IN HEMOLYTIC CONDITIONS: CORRELATION WITH PLASMA IRON LEVELS. C. Scandellari and P. Carenza (Università, Padua). Acta Isotopica, 2: 83-90(1962). (In English)

In 20 cases of hemolytic syndromes of different kinds, with maintained or intensified medullary functioning, we confirmed the frequent occurrence of a reduced percentage of Fe^{59} incorporated in red cells. We then established by statistical computation that this reduction was governed by the increase in the plasma iron pool caused by hemolysis. An inversely proportional and statistically significant dependence relationship between the two values was thus demonstrated. However, the low coefficient of determination obtained leads us to conclude that other factors than the increased plasma iron concentration must be involved in bringing about the alteration in the percentage of Fe^{59} incorporated in red cells. (auth)

27016 AN AUTORADIOGRAPHIC STUDY ON THE LOCALIZATION OF RADIOACTIVE LEAD IN BONE. P. Gasparini (Università, Padua). Acta Isotopica, 2: 91-9(1962). (In Italian)

The localization of Pb^{210} in dog bone was studied using the histoautoradiographic technique. It was shown that the highest uptake was in the primitive osteones, in correspondence of the most internal lamina. In the ripe osteones, on the contrary no, or only a small amount, of radioactivity was observed. External and internal limitant laminae usually did not take up any lead, except in one case, in which the most internal lamina of the internal limitant group showed an intense radioactivity. (auth)

27017 INTESTINAL ABSORPTION OF ^{45}Ca IN SENILE OSTEOPOROSIS. A. Caniggia, C. Gennari, V. Bianchi, and R. Guideri (Università, Siena, Italy). Acta Med. Scand., 173: 613-17(May 1963). (In English)

An oral dose of Ca^{45} was administered to 13 subjects affected by senile osteoporosis and to 5 normal subjects (2 old and 3 young). In all the subjects affected by osteoporosis a defective intestinal absorption of calcium was observed. (auth)

27018 THE EFFECT OF STRONTIUM INTAKE ON RATS MAINTAINED ON A VERY LOW CALCIUM DIET. Bengt Engfeldt, Sven-Olof Hjertoquist, and Curt Lagergren (Uppsala Univ.). Acta Soc. Med. Upsalien., 67: 239-57 (1962). (In English)

Young rats were fed a Ca-deficient diet with or without addition of Sr, but optimal in all other respects. The teeth and long bones were histologically and histochemically examined, and autoradiographic studies were made after injection of radiosulfate. The pathological changes in both groups were morphologically, histochemically, and autoradiographically in conformity with those in classic experimental rickets. The cause of the rickets was Ca deficiency but the lesions were more severe in the rats which had received Sr. In the teeth, the changes were characteristic. Thus, the organization of the odontoblasts were irregular, the predentin was thicker than normal and there was degeneration of the ameloblasts with defective formation of enamel. Delay in delivery of sulfate-containing products from chondrocytes to matrix was noted. This was evidenced by longer persistence of intracellular labeling. The delay was particularly prominent in the Sr group. It was inferred that Sr cannot replace Ca, since addition of $SrCO_3$ to the Ca-deficient diet did not prevent the occurrence of rachitic lesions. It was concluded that Sr in the intestine impaired absorption of the minimal Ca content in the food, so that only some of the available Ca could be used. (H.H.D.)

27019 THERAPEUTIC IMPLICATIONS OF STRONTIUM-85 AND CALCIUM-47 UPTAKE BY BONE METASTASES FROM BREAST CARCINOMA. E. Greenberg, K. R. Corey, P. Kenny, and J. S. Laughlin (Memorial Sloan-Kettering Cancer Center, New York). Acta Unio Intern. Contra Cancrum, 18: 956-8(1962). (In English)

With the use of whole-body scanning after the administration of tracer doses of calcium-47 and/or strontium-85 it was possible to detect bone lesions not otherwise detectable by the usual means. Results suggest that the yield in finding occult lesions will be greater in patients with symptoms than in the asymptomatic ones, although the latter group is much too small to draw a more definitive conclusion. One of our studies suggests that labeling of the skeleton with a single tracer dose of strontium-85 may help reveal the presence of a new bone lesion several months later. This method of early detection of one of the common metastatic sites of breast cancer may lead to earlier treatment and thus possibly to improved remission length and survival of patients. (auth)

27020 THYROIDAL RADIOIODINE UPTAKE RATE MEASUREMENT IN INFANTS. D. A. Fisher, T. H. Oddie, and J. C. Burroughs (Univ. of Arkansas, Little Rock). Am. J. Diseases Children, 103: 738-49(June 1962).

In neonatal term and premature infants measurements were made of thyroidal I^{131} clearance rate and 24-hr I^{131} uptake. Iodide space and renal iodide excretion were measured to allow calculation of k_1, the fraction of the iodide space cleared per minute by the thyroid. Mean iodide space was 0.432 ± 0.072 1/kg. Mean protein-bound iodine at a mean age of 25 hr in term infants was 9.1 ± 1.4 μg%. During the first 2 days in term infants the mean k_1 value was 2.37×10^{-3} per minute and mean 24-hr uptake 62%. In premature infants within the first 3 days, mean k_1 was 3.37×10^{-3} per minute and mean 24-hr uptake 72%. Mean k_1 in 21 premature infants between 5 and 55 days was 0.58×10^{-3} per minute and mean 24-hr uptake 17%. The elevated I^{131} uptake values seen neonatally were manifest by 10 hr of age and maximal within the first 48 hr. Values returned to normal by 5 days of age. Neonatal thyroid function, characterized by an early, marked elevation of serum hormonal iodine with an associated relative saturation of thyroxine-binding protein, appears to be secondary

to an increased thyroid-stimulating hormone (TSH) effect manifest by an early increase in thyroid I^{131} uptake rate. Possible etiology of the neonatal TSH stimulation is discussed in terms of TSH stimulation secondary to the neonatal fall in temperature and/or a stress response. (H.H.D.)

27021 ELECTRON MICROSCOPY OF BISMUTH INCLUSIONS. David L. Beaver and Robert E. Burr (Vanderbilt Univ., Nashville). Am. J. Pathol., 42: 609-17(May 1963).

One of the apparently innocuous side effects of Bi ingestion is the formation of intranuclear and intracytoplasmic inclusion bodies in renal tubules. These inclusions may be found many years after the cessation of treatment and are so unlike other inclusions encountered in the proximal tubular cells that their presence may be considered almost pathognomonic of previous Bi ingestion. Following the subcutaneous injection of bismuth subnitrate or subsalicylate into rabbits, intranuclear and intracytoplasmic inclusions appeared in 3 to 7 days. The inclusions, which were generally spherical in configuration, were extremely electron-dense after chrome-oxmium fixation, but following permanganate or formalin fixation were granular and exhibited an external limiting membrane. Ultrastructurally, the Bi inclusions were so unlike other known inclusions as to be separable on a morphologic basis alone. Some of the more severely injured cells went on to necrosis, and cellular remnants, along with inclusion bodies at times, were present within the tubular lumens. The ability to form inclusions, however, seemed to be limited to the proximal tubular cells, which generally could be identified by the remnants of a brush border or by the pattern of the basal labyrinth and mitochondria if the brush border were destroyed. No inclusions could be found in cells which could be definitely identified as belonging to either a distal segment or a loop of Henle. (H.H.D.)

27022 TISSUE DISTRIBUTION, KINETICS, AND BIOLOGIC HALF-LIFE OF Mg^{28} IN THE DOG. R. Lazzara, K. Hyatt, W. D. Love, J. Cronvich, and G. E. Burch (Tulane Univ. and Charity Hospital of Louisiana, New Orleans). Am. J. Physiol., 204: 1086-94(June 1963).

Magnesium-28 of a high specific activity was rapidly injected intravenously into 12 dogs and the concentration-time course curves in plasma obtained. Urinary and fecal excretion was followed in seven animals. The dogs were killed 7 min to 68 hr following injection. Seventy-four tissues were samples and assayed for Mg^{28} concentration. Plasma Mg^{24} was determined by flame spectrophotometry. With these data it was possible to follow the concentration-time course of Mg^{28} in the various tissues as well as to calculate their exchanging Mg^{24} content and effective rates of exchange. A variation in the pattern of uptake and in concentration of exchanging Mg^{24} was noted among the different tissues. During the interval from 24 to 68 hr, body exchanging Mg^{24} space and mass were found to range from 3.2 to 3.8 liters/kg and 4.9 to 5.7 meq/kg, respectively. The biologic half-life of Mg^{28} in the dog estimated from excretion data was 11 days. (auth)

27023 ^{137}Cs AND POTASSIUM IN PEOPLE AND DIET—A STUDY OF FINNISH LAPPS. J. K. Miettinen (Univ. of Helsinki), Aili Jokelainen, P. Roine, K. Lidén, Y. Naversten. Ann. Acad. Sci. Fennicae, Ser. A II, No. 120, 1-46(1963). (In English)

A field study of the contents of Cs^{137} and potassium in the diets and bodies of 190 Lapps and other inhabitants of the Inari county in northern Finland was carried out in October, 1961. The human material was obtained from 8 main living areas of Lapps in different parts of this large county. The investigation included determination of the content of Cs^{137} and potassium of samples of the most important constituents of the diet. The diet of each individual was investigated by means of the interview method. The intake of Cs^{137} and potassium through the food was calculated. During the winter (1960 to 1961) reindeer meat showed an average of 18.0 nc/kg fresh weight. In the autumn of 1961 lower values were found. In pike the Cs^{137} content was found to be 2.8 nc/kg fresh weight and in milk up to 0.6 nc/kg. The amount of radiocesium in reindeer meat, fish and milk was found to contribute 98 to 99% of the total dietary intake of Cs^{137}. The highest body burden observed in a reindeer breeding Lapp was 790 nc Cs^{137}. On the average the male reindeer-breeding Lapps contained 245 nc Cs^{137}. Corresponding females and children had an average of 122 nc Cs^{137} and 51 nc Cs^{137}, respectively. The body burdens are found to be mainly a function of the Cs^{137} intake. Twice as high average body burdens as those mentioned are predicted to occur in April to May, 1962. From dietary data of the year preceding the date of measurement and the obtained body burden of Cs^{137} an excretion rate corresponding a biological half-time of 65 days for adult Lapps was found; for children the figure was 44 days. The annual radiation dose from the body burden of Cs^{137} has been estimated to 62 mrem for men, 26 mrem for women and 15 mrem for children, all of the reindeer-breeding group. The intake of potassium in the diet and the average body content of potassium in the different occupational groups were also determined. Finally a comparison between the Cs^{137} content of Swedish and Finish Lapps is made. (auth)

27024 THEORETICAL AND PRACTICAL ASPECTS OF ELIMINATION OF RADIONUCLIDES. J. Schubert (Univ. of Chicago). Ann. Univ. Saraviensis, Med., 8: 270-3 (1960). (In German)

The use of chelating agents to accelerate the excretion of radioisotopes is reviewed. (H.H.D.)

27025 EFFECT OF CHELATING AGENTS ON RENAL RETENTION OF URANIUM. Krista Kostial, Kata Voloder, V. B. Vouk, and O. Weber (Inst. for Medical Research and Occupational Medicine, Zagreb). Arhiv Hig. Rada i Toksikol., 13: 289-93(1962).

In rats, 7.6 mg/kg of uranyl nitrate was injected intraperitoneally; 28% of the dose was retained in renal tissue 3 hours after administration. Diethylenetriaminepentaacetic acid immediately after U reduced the retention to 12% ($P = 0.05$) while hydroxydiphenyl ether phosphate paradoxically increased it to 55% (P between 0.01 and 0.02.) The latter chelating agent is assumed ineffective as potential therapeutic agent because the U complex formed with it is not very water-soluble and cannot diffuse. (OTS)

27026 TOXICITY OF SOME NEW CHELATING AGENTS FOR RADIOSTRONTIUM REMOVAL. Krista Kostial, Tea Maljkovic, Blanka Slat, and O. Weber (Inst. for Medical Research and Occupational Medicine, Zagreb). Arhiv Hig. Rada i Toksikol., 13: 295-8(1962).

Studies were made in acute toxicity of 5 chelating agents. The results showed that rat intraperitoneal LD_{50} of EDTA is 396.9 mg/kg (1.06 millimole/kg), dimethylene DTA 675.5 (1.89), propylene DTA 356.6 (1.10), of N-hydroxyethylene DTA 337 (1.21), and diethylenetriaminepentaacetic acid 665.6 (1.69.) (TCO)

27027 DO IRRADIATED FOODSTUFFS PRODUCE RADIOMIMETIC EFFECTS? L. Bugyaki, A. Lafontaine,

J. Moutschen-Dahmen, and M. Moutschen-Dahmen (Inst. of Hygiene and Epidemiology, Brussels and Université, Liege). Atompraxis, 9: 194-6(May 1963). (In French)

Under the given experimental conditions, no radiomimetic effect on lysogenic bacteria could be demonstrated for glucide or irradiated proteins with doses of up to 5 Mrads. (auth)

27028 THE INCORPORATION OF RADIOACTIVE PHOSPHORUS IN THE LEUCOCYTE DURING THE EXTRUSION OF PROTEIN INDUCED BY STAPHYLOCOCCAL LEUCOCIDIN. A. M. Woodin and Antonnette A. Wieneke (Oxford Univ.). Biochem. J., 87: 480-7(June 1963).

Incubation with leukocidin stimulates the incorporation of P^{32} into the adenosine tri- and di-phosphate and guanosine tri- and di-phosphate of the leukocyte. Incubation with leukocidin does not increase the permeability of the leukocyte to orthophosphate and in the presence of P^{32} does not increase the radioactivity of the intracellular orthophosphate. In the presence of fluoride, iodoacetate, or arsenate the incorporation of P^{32} into the lipids and nucleotides of the leukocidin-treated leukocyte is partially inhibited. The extrusion of β-glucuronidase is not affected under these conditions. Omission of calcium from the medium stimulates the incorporation of P^{32} into the lipids of the leukocidin-treated leukocyte and reduces the amount of incorporation into the nucleotides. Either component of leukocidin adsorbed on the leukocyte can be neutralized by antibody. Addition of antibody to the leukocidin-treated leukocyte does not inhibit the incorporation of P^{32} into the nucleotides. Treatment with leukocidin decreases the rate of loss of radioactivity from the nucleotides of leukocytes labeled with P^{32} and suspended in a medium of low specific radioactivity. Treatment with leukocidin reduces the amount of [C^{14}]adenine incorporated into adenosine triphosphate and the amount of [C^{14}]acetate incorporated into the lipids of the cell. It is suggested that the stimulation of incorporation of P^{32} in the leukocidin-treated leukocyte does not result from an increased rate of turnover of any phosphorus compound of the cell but can result from direct utilization at the cell surface of the external orthophosphate. (auth)

27029 COMPARATIVE STUDIES OF THE METABOLISM OF STRONTIUM AND BARIUM IN THE RAT. P. H. Bligh and D. M. Taylor (Royal Cancer Hospital, London). Biochem. J., 87: 612-18(June 1963).

The comparative metabolism of Sr^{85} and Ba^{140} was studied in the ends and shaft of the femur, in the molar and incisor teeth, and in the serum, liver, lungs, muscle, and submaxillary gland of rats aged 6 to 8 weeks and 15 months by using double-tracer techniques. In bone the uptake of both Sr^{85} and Ba^{140} decreases with age, and more Ba^{140} than Sr^{85} is retained. It is suggested that this may be due to deposition of Ba^{140} by surface adsorption as well as by exchange. Both Sr^{85} and Ba^{140} are taken up by the incisor teeth of young and old rats, the uptake in the old animal being about twice that of the young rat. In molar teeth the uptakes of both Sr^{85} and Ba^{140} are similar in old and young animals, but in the old animal both are rapidly removed from these teeth, in contrast with the young animal where retention is prolonged. After intravenous injection the concentrations of Sr^{85} and Ba^{140} in the soft tissues closely follow those in the blood, and except in the submaxillary gland the Sr^{85}:Ba^{140} ratio is always greater than 1. The submaxillary gland concentrates both Sr^{85} and Ba^{140} from the serum, but the concentration of Ba^{140} is always greater than that of Sr^{85}. The uptake of both Sr^{85} and Ba^{140} in soft tissues is generally in proportion to the calcium content of the tissues. (auth)

27030 INCREASE IN THE CHEMOTHERAPEUTIC COEFFICIENT OF MECHLORETHAMINE BY THE ACTION OF THE RADIOPROTECTIVE AGENT SODIUM DIETHYLDITHIOCARBAMATE. Lorenzo Cima and Franco Pozza (Università, Padua). Chemotherapia, 6: 97-111(1963). (In Italian)

In mice of the SMZ strain the protective effect of various kinds of radioprotectant agents against the toxicity of the alkylating agent mechlorethamine (HN2) was investigated. HN2 was injected subcutaneously in doses of 6 mg/kg, corresponding to the $LD_{99/6}$. The most effective protective agent tested was the chelating agent Na diethyldithiocarbamate (DEDTC), which when injected intraperitoneally in doses of 335 mg/kg raised the 4-day survival rate to 90% from a control value of 20%. Other chelating agents were less effective, showing the specific action of the dithiocarbamate anion: tetraethylthiuram disulfide (disulfiram), 2-guanidinothiazolidone, and diethylamine. Moderately effective against the toxicity of HN2 were (in decreasing order): reserpine, chlorpromazine, propylene glycol, malononitrile, glutathione, cysteamine, oxytocin, and Na ethylenediaminetatraacetate. Tryptamine was ineffective and cysteine augmented the toxicity of HN2. DEDTC did not modify the carcinostatic effect of HN2 against Ehrlich ascites tumor and thus, by markedly reducing the toxicity of HN2, enhances the therapeutic index of HN2 3 fold. The protective effect of DEDTC and the other radioprotectant agents against HN2 suggest that alkylating agents and ionizing radiation have analogous effects on tissue constituents. (H.H.D.)

27031 THE ABSORPTION OF RADIOACTIVE CESIUM BY BARLEY. Pierre Ferron. Compt. Rend., 256: 4278-80(May 13, 1963). (In French)

The extent to which the absorption of radioactive cesium by barley affected by competition with other cations was investigated. (tr-auth)

27032 SIMPLE METHOD FOR THE PREPARATION OF I^{131}-LABELED INSULIN. G. Boeuf, R. Depieds, C. Cartouzou, and H. Gignoux (Faculté de Médicine, Marseille). Compt. Rend. Soc. Biol., 157: 137-40(1963). (In French)

Some modifications of the Banerjee technique for the simple and rapid preparation of I^{131}-labeled insulin are reported. Pig insulin is made to react in buffered solution with sodium metabisulfite and human albumin in the presence of carrier-free I^{131}. Electrophoresis at 4°C separates the different reaction constituents. The I^{131} has from 0 to 5% decontamination by degradation products, and it has an activity of 100 to 500 $\mu C/\mu g$. (J.S.R.)

27033 STRONTIUM-90 CONTENT OF HUMAN PLACENTA AND BONE OF THE NEWBORN. O. Pribilla (Universität, Kiel). Geburtsh. Frauenheilk., 23: 63(Jan. 1963).

Results are reported relating to a research program begun in 1958 to follow the Sr^{90} levels in human bone. At the beginning of this study the average level in bone was 1.07 pc/g Ca. In 1959 the level rose considerably, then declined in 1960 and 1961. Incorporation of the isotope in humans of different ages was studied, particularly in the fetus and newborn which have high incorporation rates because of new bone formation, Sr^{90} being incorporated at the same rate as Ca. The Sr content of the fetus was found to be higher than that of the mother, in spite of the fact that all fetal nutrition is provided through the mother. Analysis of 120 placentas showed a mean value of 1.05 pc Sr^{90}; the level

in bone of newborn infants was 0.88 pc. These levels in bone were related to changes in the Sr^{90} levels in milk in Germany during this period. (H.H.D.)

27034 INVESTIGATIONS OF THE INCORPORATION OF RADIOACTIVE SULFUR (S^{35}) IN UTERINE SECRETIONS. M. Rodriguez-Galindo (Universitaets-Frauenklinik, Cologne). Geburtsh. Frauenheilk., 23: 163-74(Feb. 1963).

Radioautographic studies were made in the guinea pig after intraperitoneal injection of S^{35}-sulfate. In ovariectomized animals no uptake of radioactivity was detected in endometrial stroma and epithelium 24 hr after the injection; the depression of S^{35} uptake was associated with atrophy of the tissue elements. Attempts were made to determine the minimum dose of estrogen required to restore S^{35} uptake in uterine structures. The smallest dose of estradiol benzoate given as a single injection able to restore uptake by endometrium was 0.01 mg. With this dose, S^{35} was incorporated by the 15th day after its injection, but not before. With larger doses (0.1 to 0.25 mg), S^{35} appeared in the stroma and in the secreted mucus. Injection of 0.25 mg estradiol benzoate followed by 10 mg progesterone or 10 mg testosterone markedly increased the concentration of S^{35} in endometrial glands and stroma and in mucus secreted into the uterine lumen. The results show the important role of estrogen in the formation and secretion of uterine mucopolysaccharides. (H.H.D.)

27035 ON THE MECHANISM OF ACTION OF X IRRADIATION AND CYTOSTATIC SUBSTANCES ON TUMOR CELLS. H. Maass (Universitaet, Hamburg-Eppendorf, Ger.). Geburtsh. Frauenheilk., 23: 210-12(Feb. 1963).

The lethal effects of x rays and cytostatic agents may be attributed to inhibition of glycolysis and protein synthesis as well as to inhibition of DNA synthesis. Inhibition of DNA synthesis may result in deficiency of enzymes involved in cell reproduction; some of the enzymes may be required for DNA synthesis. Either their formation or activation may be blocked by irradiation, whereas direct injury of DNA by radiation may have only a subordinate role in cell death. Synthesis of diphosphopyridine nucleotide (DPN) is also particularly sensitive to radiation, as shown by the finding that irradiated Yoshida ascites sarcoma cells have a lower DPN content after exposure to high doses. However, DNA synthesis is diminished by more moderate doses, in the range of those used in human radiotherapy. The lowered DPN content of irradiated tumor cells may be related to the previously observed postirradiation inhibition of glycolysis and protein synthesis. The cytostatic agent E 39(2,5-bis [ethyleneimino]-3,6-bispropoxy-1,4-benzoquinone) produced parallel changes, inhibiting both DPN synthesis and glycolysis. E 39 could inhibit DNA synthesis under conditions in which glycolysis was unaffected. Treatment of rats with E 39 reduced the incorporation of iron in erythrocytes. It also reduced the half life time of erythrocytes in rats from 14 to 11 to 13 days and in carcinoma patients from 33 to 22 days. (H.H.D.)

27036 FOETAL METABOLISM OF CAESIUM-137 IN THE RAT. W. Moore, Jr. and C. L. Comar (Cornell Univ., Ithaca, N. Y.). Intern. J. Radiation Biol., 6: 233-9(Mar. 1963). (In English)

Cesium-137 appeared rapidly in the fetus after oral administration to the dam, reaching equilibrium with maternal blood in approximately 16 hours. The percentage dose per gram of fetal tissue appeared to be independent of age or weight of the fetus. The general pattern of distribution was the same in the fetuses as in the dam; however, the accumulating ability of fetal tissues was less. The Cs^{137}/K ratio was greater in the dam than in the fetus. (auth)

27037 URINARY EXCRETION OF ^{32}P AND DESOXYRIBOSE IN RATS FOLLOWING IRRADIATION OR ADMINISTRATION OF A SINGLE DOSE OF METHIONINE SULPHOXIMINE. Jaroslav Koloušek and Zdeněk Dienstbier (Charles Univ., Prague). Intern. J. Radiation Biol., 6: 271-80(Mar. 1963). (In English)

The urinary excretion of P^{32} was investigated in rats following the intraperitoneal administration of a single dose of 50 mg and 150 mg L-methionine sulfoximine, and compared with the effect of x radiation, the administration of 2,4-dinitrophenol, and scalding of 50 per cent of the body surface. After the administration of a single dose of methionine sulfoximine, the excretion of P^{32} in the urine rises, depending on the amount administered. The effect of methionine sulfoximine and radiation of the urinary excretion of P^{32} is similar. A similar effect is observed after administration of 2,4-dinitrophenol, but scalding has the reverse effect, i.e., the excretion of P^{32} is reduced as compared with controls. After the administration of methionine sulfoximine, as after irradiation there is an increased excretion of Dische-positive substances, i.e., of urinary desoxyribose in rats. The increased urinary excretion of P^{32} and desoxyribose in rats may be due to a disorder in the mechanism of oxidative phosphorylation. (auth)

27038 RADIOSTRONTIUM REMOVAL FROM MILK: DETERMINATION OF APPARENT EQUILIBRIUM CONSTANTS OF THE EXCHANGE REACTIONS OF SODIUM, POTASSIUM, CALCIUM, AND MAGNESIUM WITH AMBERLITE IR-120. Albert R. Landgrebe, L. F. Edmondson, and F. W. Douglas (Dairy Products Lab., Dept. of Agriculture, Washington, D. C.). J. Agr. Food Chem., 11: 156-7(Mar.-Apr. 1963).

The apparent equilibrium constants for the exchange reactions between resin and aqueous solutions containing Ca, K, Na, and Mg were determined for a series of total concentrations of the chlorides of the ions. The constants were used to calculate the required solution composition for charging the resin to a desired composition. A 2.1 × 30.5 cm column of Amberlite IR-120, originally in the H form, was equilibrated with solutions of the cations adjusted to pH 6.6. From determinations of the apparent equilibrium constants at different ionic strengths, the desired concentrations of the charging solutions could be calculated, in order to maintain the original cation composition of milk. The procedure has application for charging a resin so that it will be in equilibrium with milk when it is desirable to remove specific cations, such as Sr^{90} or other cationic radionuclides, while leaving the other components unchanged. (TCO)

27039 RADIOCALCIUM UPTAKE IN THE CALCIFIED TISSUES OF RHESUS MONKEYS AT VARIOUS TIME INTERVALS. Peter K-J. Yen and James H. Shaw (Harvard Univ., Boston). J. Dental Res., 42: 168-76(Jan. 1963).

Uptake of Ca^{45} in skeletal and dental tissues of adult rhesus monkeys was studied at 5-, 27-, 51-, and 168-hr intervals after intravenous Ca^{45} administration. In all calcified tissues the uptake was highest in the layer adjacent to its tissue-fluid environment, irrespective of whether this was connective-tissue fluid, serum, or saliva. Decreasing Ca^{45} uptake gradients from the internal dentin and surface enamel toward the dentino-enamel junction and from the subperiosteal and subendosteal layers toward the central layer in both long and flat bones were observed. The uptake in the sutural area of the calvarium was higher than in the adjacent bone. An increasing specific activity ratio from the 5-hr sample to the 168-hr sample was observed in each corresponding layer of the bones and teeth. In contrast to

the low specific activity ratios of calcified tissues the specific activity ratios of the soft tissues indicated that their Ca at the time of sacrifice was in complete equilibration with Ca in blood. The highest level of Ca^{45} was excreted in urine during the first day, totaling 12.3%, with a relatively consistent low excretion each day thereafter. A total of 18.1% of injected Ca^{45} was excreted in 168 hr. (TCO)

27040 STUDIES IN THE REGULATION OF INTESTINAL IRON ABSORPTION. Philip J. Charley, Clyde Stitt, Ernest Shore, and Paul Saltman (Univ. of Southern California, Los Angeles). J. Lab. Clin. Med., 61: 397-410(Mar. 1963).

Experiments were carried out to elucidate the regulatory mechanisms operative in the transport of iron from the lumen of the intestine into the blood. By the development of a surgical procedure, we were able to continuously monitor and record the rate at which Fe^{59} introduced into a washed segment of the gut appeared in the circulation of an intact rabbit. Chelation of the metal plays a fundamental role in its availability for transport across the intestinal membranes. Both Fe^{2+} and Fe^{3+} are rapidly absorbed when presented to the mucosal wall suitably chelated with fructose. No demonstrable time lag for the entry of activity, other than that required for the labeled blood to move from the circulatory system of the bowel into the detector, has been observed. The entry of iron into the blood from the lumen appears to be a function of the level of unbound iron-binding capacity of the plasma. The injection of unsaturated transferrin into an animal whose uptake of iron has reached a plateau caused the immediate resumption of the transport of activity. Neither saturated transferrin from anemic plasma nor dense suspensions of red blood cells was effective in increasing iron uptake. A hypothesis for the regulation of iron uptake based upon control by chelation and equilibrium binding is proposed and discussed in the light of our own as well as other investigators' results. (auth)

27041 ABSORPTION OF RADIOACTIVE ALBUMIN FROM THE LUNGS OF NORMAL DOGS. Alvin L. Schultz, Jerome T. Grismer, and Francisco Grande (Univ. of Minnesota, Minneapolis). J. Lab. Clin. Med., 61: 494-500 (Mar. 1963).

The absorption of protein from the pulmonary alveoli may be important in the resolution of congestive and inflammatory disorders of the lung. Previous studies have indicated very slow or no significant pulmonary absorption of protein. The present study, using a sensitive technique, was undertaken to determine the rate at which albumin was removed from the alveoli, and to what extent whole protein was absorbed. Observations were made of the absorption of radioactivity into the plasma from solutions of I^{131}-iodide and albumin-bound I^{131} instilled directly into the lungs of normal dogs. Iodide was rapidly absorbed from the lung. Albumin was absorbed more slowly. However, the concentration of absorbed albumin was 2.47 per cent of the dose per 100 ml plasma at 24 hours. Assuming an average plasma volume of 700 ml, the total quantity of albumin absorbed from the lung into the plasma was 5 per cent of the dose at 5 hours and 15 per cent at 24 hours. Separation of the plasma radioactivity into free and albumin-bound fractions indicated that albumin was absorbed from the lung predominantly as intact protein. (auth)

27042 GAMMA SPECTROMETRIC EXPLORATIONS CONDUCTED ON PATIENTS TAKING THE CURE AT LUCHON. R. Grandpierre, Y. Arnaud, and P. Blanquet (Faculté de Médecine, Bordeaux). J. Med. Bordeaux Sud-Ouest, 138: 1036-45(Aug. 1961).

Studies were conducted on persons ingesting mineral waters at Luchon to determine the deposition of radioisotopes in their bones. In addition to drinking the water, the patients were also exposed to it in the form of aerosols and as steam in a vaporarium. The radioactivity of the mineral water is appreciable: 20 mμC/l Rn and 0.2 mμC/l Ra. The vapors contain up to 100 mμC/l Rn. Thirty patients were examined, using a NaI crystal held over the knee with and without Pb shielding, to detect bone deposition of the natural γ emitters Pb^{210}, Ra^{226}, and Po^{210}. Background activity in the Luchon region gave a large peak at ~100 kev, which reduced the sensitivity of measurements of Pb^{210} at 47 kev and Ra^{226} at 186 kev; however, it was possible to detect these 2 radioelements in some patients. Slight activity at 800 kev was also detectable. The 2 or 3 peaks were obtained most frequently in patients being treated in the vaporarium; 8 out of the 14 tested gave positive readings, indicating absorption of Rn daughter products in their bones. In patients being treated by other means, the readings were doubtful or negative. The readings in positive cases reached 100 cpm at 47 and 186 kev and 20 cpm at 800 kev, the latter reading presumably corresponding to the 802-kev γ emission of Po^{210}. A detailed statistical analysis is provided to establish the significance of the findings. (H.H.D.)

27043 THE ATTACHMENT OF A COMPLEX URANYL FLUORIDE TO TOBACCO MOSAIC VIRUS (TMV). K. C. Holmes and R. Leberman (Medical Research Council, Cambridge, Eng.). J. Mol. Biol., 6: 439-41(May 1963).

Three different heavy-atom derivatives were prepared: TMV-uranyl was obtained by centrifuging a saturated solution of $K_3UO_2F_5$ containing 2% (w/v) TMV, and orienting the virus gel in the presence of the excess $K_3UO_2F_5$; TMV-uranyl gel (washed) was resuspended in imidazole-nitrate buffer, pH 7.4, centrifuged, and the pellet oriented; TMV-Hg-uranyl (washed) was prepared using TMV whose sulfydryl groups were previously blocked with methylmercury nitrate. The heavy-atom binding was estimated by x-ray diffraction. Neither the composition of the complex ion bound to the protein (fluoride ions may be displaced from the pentafluoride complex in reaction with the protein) nor the nature of the ligand groups on the protein is known. Preliminary investigations, however, show that there is some interaction between the uranyl fluoride complex and the sidechain of tyrosine. The uranyl fluoride occupying the 68-Å site can be reduced or washed out with imidazole (and also tris) buffer. The 56-Å sites appear to be closely related in both methylmercury and uranyl fluoride derivatives, since blocking this site with the former prevents any addition of the latter. The 26-Å site is relatively stable and survives washing with imidazole buffer. (H.H.D.)

27044 FLUORIDATED WATER AND THE SKELETAL UPTAKE OF Sr^{85} AND Ca^{45} BY YOUNG RATS. F. W. Lengemann and C. L. Comar (Cornell Univ., Ithaca, N. Y.). J. Nutr., 79: 195-9(Feb. 1963).

Young growing rats were given various levels (1 to 100 ppm) of fluoride in drinking water to which Sr^{85} and Ca^{45} had been added for test periods of from 10 to 21 days. At the end of this period samples of bone were assayed to estimate the effect of fluoride on the retention of both radionuclides. Addition of fluoride to the water at levels of 1 ppm did not significantly affect the degree of bone mineralization, uptake of Sr^{85} and Ca^{45}, or discrimination between the isotopes. At 10 ppm the results on Sr^{85} uptake were equivocal, there being an increase in one study and

a decrease in another. A positive effect of 100 ppm of fluoride upon the preferential uptake of Sr^{85} was noted in 2 experiments using 2 different ages of rats. The increase, however, was quite small, being only 30% above that of the control animals, even though the total fluoride intake was more than 10 times greater. The age of the rats was unimportant since rats of 4, 7, and 9 weeks of age at the start of the experiments all showed essentially the same pattern. Pretreatment experiments showed that animals receiving fluoridated water 21 days previous to exposure to Sr^{85} would not take up more Sr^{85} than animals that had not received fluoridated water. Addition of fluoridated water and Sr^{85} simultaneously to the diet did not lead to a greater deposition of Sr than with other groups either. It was concluded that the levels of fluoride customarily added to drinking water will not lead to an increase in the Sr^{90} concentration in the bones of growing children. (TCO)

27045 THE HUMORAL TRANSPORT OF BERYLLIUM. Andrew L. Vorwald (Wayne State Univ., Detroit). J. Occupational Med., 3: 567-74(Dec. 1961).

The mode of transport of Be in body fluids was investigated by ultracentrifugal, dialysis, and immunological techniques. Serum specimens were incubated with either Be oxide or Be sulfate at physiologic pH and temperature. In an in vitro study, a buffered 20% aqueous glycerol solution served as a protein-free control medium. The immunological study, evaluated by the allergic and anaphylactoid reaction as well as by the precipitin reaction, failed to show the development of antigenic property by the Be-incubated serum. The results were consistent with the assumption that no significant extracellular Be-protein interaction takes place in vivo. Dialysis also demonstrated that presence or absence of protein in the medium has no effect on the diffusion rate of added Be at a concentration of 10^{-4} mole/l. Ultracentrifugal experiments, in addition to corroborating the results, also showed that the added Be is separable into at least 2 distinct fractions. Both possessed well-defined migration rates in the ultracentrifugal field, indicating that ionic Be in excess of 0.01 μM/ml was no longer present. A form having a density greater than 1.06 appeared to be the orthophosphate. Another form, having a density of about 1.04, seemed to be the hydroxide. For the humoral transport of Be, it is proposed that if soluble Be enters by any parenteral route, immediate precipitation of Be orthophosphate takes place in situ. A minor portion of Be (2 to 3% at concentrations up to 10^{-3}M) is precipitated as the hydroxide; the amount increases sharply when plasma Be attains a concentration high enough to exhaust all plasma phosphate. This precipitate is very light (density about 1.04) and more soluble than the orthophosphate. The colloidal precipitates are in dynamic equilibrium with any noncolloidal deposit formed in situ, as well as with traces of the ionic portion; the biological half life of the element in an organ is dependent on the relative amounts of the 3 forms. (TCO)

27046 RELATIONSHIP BETWEEN ISOTOPICALLY EXCHANGEABLE CALCIUM AND ABSORPTION BY PLANTS. P. Newbould (A.R.C. Radiobiological Lab., Wantage, Berks, Eng.). J. Sci. Food Agr., 14: 311-19 (May 1963).

When soils are suspended in solutions of calcium chloride labeled with radioactive tracer, isotopic exchange with the labile soil-calcium occurs rapidly. This may be followed by a slow secondary exchange reaction, but its magnitude is not great and equilibrium is nearly, if not completely, attained with 7 days. When, however, plants are grown in soil throughout which carrier-free calcium-45 has been thoroughly mixed, the Ca^{45} absorbed by the plants equilibrates with a quantity of soil-calcium larger than that which undergoes isotopic exchange when soils are suspended in solutions of labeled calcium chloride. The analysis of plants grown for varying periods shows that equilibration can continue for several weeks, and that the quantity of soil-calcium with which the Ca^{45} is associated can be increased by growing plants under exhaustion conditions. In five soils, the extra calcium which equilibrated with Ca^{45} in this way never exceeded 3.5% of the total soil-calcium, and was usually considerably lower. The continued equilibration of Ca^{45} with soil-calcium causes the specific activity (Ca^{45}/stable Ca) of the calcium entering plants to decrease. Because the calcium in plant roots has, on average, been absorbed more recently than that in shoots, the latter shows higher specific activities. The causes of these effects are discussed, and their significance in the interpretation of results of experiments which involve the use of Ca^{45} as a tracer in research work on soil/plant relations is considered. (auth)

27047 THE INFLUENCE OF CERTAIN METABOLIC FACTORS ON RADIOSENSITIVITY. Z. M. Bacq (Université, Liège). Laval Med., 34: 80-4(Jan. 1963). (In French)

From Symposium on Radiosensitivity, Laval Univ., Quebec, Sept. 1962.

A survey of animal species with respect to total intensity of the metabolism and body temperature showed that the radiosensitivity of mammals is greater than that of the poikilothermic animals; it is also greater among the latter at a high rather than at a low temperature. An exception is the bird, which shows a little less radiosensibility than mammals even though their metabolism and internal temperature are much higher. In hibernating mammals and bird eggs, the lesions manifest themselves only at awakening or at hatching time. The possible presence of natural radioprotective substances in some of the animals is discussed, including, glutathione, coenzyme A, cysteamine, free amino acids, amines, and proteins. The observed induction of radioprotection by fluoroacetate is explained in terms of aconitase inhibition, which increases the percentage of citric acid inside the cells. Two possible interpretations for this are proposed: a chelation effect and inhibition of a DNase, or deviation of metabolism towards a less radiosensitive pathway. Examination of the parallelism between radiosensitivity and sensitivity to cyanide suggests that the metabolic pathways sensitive to cyanide are also the most radiosensitive. Local trauma appears to slightly inhibit the injurious effects of radiation as shown by passing a needle under the skin of a young mouse or the injection of a small quantity of fresh serum (even from mice of the same strain), both of which diminished the x-ray depilatory effect. (H.H.D.)

27048 MEASUREMENT OF THE EARLY UPTAKE OF RADIOACTIVE IODINE BY THE THYROID GLAND; A METHOD REQUIRING REDUCED IRRADIATION. H. David Mosier, Marjorie K. Armstrong, and Marvin A. Schultz (Univ. of California, Los Angeles). Pediatrics, 31: 426-32(Mar. 1963).

The use of an antithyroid drug during the first few minutes of I^{131} uptake to block further uptake was investigated. In the previous studies of early uptake, doses of I^{131} ranged from 4 to 100 μC. In the present studies doses of 0.2 to 5 μC were used to assess the feasibility of the early uptake methods in these experiments. The data show that it is possible to distinguish hyperthyroidism from euthyroid or hypothyroid states during the first few minutes and that thiiodothyronine suppression tests can be satisfactorily

performed during this period. Continuous recording of the uptake permits detection of hyperthyroid quality of the curve during the first few seconds of the uptake. If sodium perchlorate is administered orally after the 11-min count, the 24-hr uptake value can be limited to about 2% of the dose in euthyroid individuals. Thus, the technique described offers an opportunity to limit the irradiation of the thyroid in certain diagnostic studies. Two instrumentation assemblies are described. (TCO)

27049 THE METABOLISM OF STRONTIUM IN ADULT HUMANS. G. W. Dolphin and I. S. Eve (United Kingdom Atomic Energy Authority, Harwell, Berks, Eng.). Phys. Med. Biol., 8: 193-203(June 1963).

The metabolism of calcium and strontium in adults is reviewed. Values are proposed for intake, absorption, and excretion of calcium and strontium by a standard adult on an average diet similar to that in the United Kingdom. Fractional transfer values given in the current ICRP (1959) Recommendations are compared with those derived from the models for strontium and calcium metabolism. (auth)

27050 THE USE OF TRITIUM FOR THE DETERMINATION OF RESIDUAL ESTROGEN IN THE TISSUES OF BROILERS FED 3,4-DIANISYL-2-t-3-HEXENE. Don deSteiguer, Ernest M. Hodnett, Robert D. Morrison, and Rollin H. Thayer (Oklahoma State Univ., Stillwater). Poultry Sci., 41: 1815-22(Nov. 1962).

3,4-Dianisyl-2-t-3-hexene was synthesized and included in the diet of growing broilers at the rate of 50 mg/lb of ration. Treatment group A received the estrogen-containing diet for 21 days followed by a 3-day depletion period, while treatment group B received the same diet for 21 days with no depletion period. Tissue samples of breast, thigh-leg muscle, liver, blood, skin, and adipose tissue were collected and freeze-dried. Estrogen residues were found to be present in all tissues tested. The 3-day depletion period resulted in a slight but insignificant decrease in residual estrogen. The analytical methods used for tritium analysis gave good results at activity levels of less than 3×10^{-10} c. Data indicated the integrity of the label position to be sound while undergoing biological activity. It is recommended that experimental procedures be modified by reducing the analytical time, eliminating duplicate analyses, increasing the number of samples assayed, and, if possible, increasing the number of animals used. (TCO)

27051 RADIUM-226 IN HUMAN DIET AND BONE. Naomi A. Halden, Isabel M. Fisenne, and John H. Harley (U. S. Atomic Energy Commission, New York). Science, 140: 1327-9(June 21, 1963).

The mean radium-226 content of samples of vertebrae from New York City and San Francisco is 0.032 and 0.026 picocuries of radium-226 per gram of calcium, respectively. The ratio of these two mean values is associated with a similar ratio of radium-226 to calcium found in the diet at the two locations. A plot of the radium-226 content of bone as a function of age indicates that there is no marked difference in levels of bone radium with age. (auth)

27052 THE ROLE OF MAGNESIUM IN BIOLOGIC PROCESSES. Jerry K. Aikawa. Springfield, Illinois, Charles C. Thomas, 1963. 127p. $6.75.

Present knowledge of experimental magnesium deficiency is analyzed and correlated with clinical magnesium deficiency in veterinary medicine. The role of magnesium in hibernation is explored. An analysis of methods currently available for the measurement of magnesium in biological materials is presented. The essential role of magnesium in the many biochemical processes of photosynthesis and biologic oxidation and in human disease is stressed. Properties of Mg^{28} are described. Studies of the plasma clearance of Mg^{28}, its tissue uptake, and excretion are summarized. Effects on magnesium metabolism of various drugs and the nature of magnesium in the bone are discussed. (C.E.S.)

Fallout and Ecology

27053 (HW-SA-3050) RADIOECOLOGICAL STUDIES OF NORTHERN ALASKA. W. C. Hanson, D. G. Watson, W. H. Rickard, and J. J. Davis (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). May 17, 1963. Contract AT(45-1)-1350. 10p.

Results of radioecological studies in Northern Alaska during 1961 and 1962 are reported. Increased amounts of Mn^{54}, Zn^{65}, $Zr^{95}-Nb^{95}$, $Ru^{106}-Rh^{106}$, Cs^{137}, and $Cs^{144}-Pr^{144}$ were detected in vegetation samples from the Cape Thompson region following the resumption of nuclear weapons testing on Sept. 1, 1961. An increase in $Zr^{95}-Nb^{95}$, $Ru^{106}-Rh^{106}$, and $Ce^{144}-Pr^{144}$ was detected in Cornicularia lichen samples collected 3 weeks after the initial weapons test and all radioisotope concentrations in 1962 samples achieved levels approximating or exceeding those measured in 1959. Measurements were also made on the concentration of I^{131} and Sr^{90} in animals and plants. Data are tabulated. (P.C.H.)

27054 (TID-18864) UPTAKE OF RADIOACTIVE MATERIALS FROM A NUCLEAR REACTOR BY SMALL MAMMALS AT THE NEVADA TEST SITE. Frederick B. Turner, Bruce Kowalewsky, Richard H. Rowland, and Kermit H. Larson (California. Univ., Los Angeles. School of Medicine. Lab. of Nuclear Medicine and Radiation Biology). June 1963. Contract AT-04-1-GEN-12. 13p.

Studies were made on the degree to which radioactive isotopes released from a nuclear reactor (Kiwi-A) test contributed to the tissue burdens of rabbits and rats. Gross beta activities in tissues of rabbits collected within the fallout pattern after the test (July) were consistently greater than activities in rabbits analyzed before the test (February). However, muscles from rabbits collected outside the pattern in July showed significantly greater radioactivity than February samples. This suggests that the increases in gross beta activity can be ascribed to stratospheric fallout. The gross beta activities of the muscle, bones, skins, and gastrointestinal tracts (and contents) of the July rodents were higher than in the specimens collected in February. Gross beta activities of thyroids collected in July ranged from 18 to 3280 disintegrations per minute for rodents and 133 to 1740 disintegrations per minute for rabbits. (P.C.H.)

27055 ROLE OF THE GENOTYPE IN CONTROLLING ACCUMULATION OF STRONTIUM-89 BY PLANTS. D. C. Rasmusson, L. H. Smith, and W. M. Myers (Univ. of Minnesota, St. Paul). Nature, 198: 1008(June 8, 1963).

Large genotypic differences for Sr^{89} accumulation were found in grain, stems, and leaves of six varieties of barley and wheat grown in the greenhouse with trace amounts of Sr^{89} added to the soil prior to planting. The magnitude of the differences in Sr^{89} content among the varieties studied indicates that the hazard associated with radiostrontium in the soil can be reduced by growing varieties that absorb low quantities of Sr or by growing varieties that accumulate low concentrations of Sr in plant parts used for food. (C.H.)

Radiation Effects on Living Tissues

27056 (CERN-63-17) AN IONIZATION CHAMBER FOR THE ESTIMATION OF THE BIOLOGICAL EFFECTIVENESS OF RADIATION. A. H. Sullivan and J. Baarli (European Organization for Nuclear Research, Geneva). May 1, 1963. 18p.

A simple parallel plate ionization chamber was constructed to study the possibility of using its properties for measuring the average specific ionization of secondary radiation. The chamber has been operated with pressures of up to 6 atmospheres of tissue equivalent gas and with field strengths of up to 2000 volt/cm. It has been found that the collected ionization current can be represented over a considerable range of field strengths by $i = K V^n$ where K is a function of dose-rate and type of radiation, V is the electric field strength and n is an index, depending only on the type of radiation used. The response of such a chamber can be deduced from existing theories of columnar recombination, enabling the index n to be related to recommended values of RBE. Various sources of radiation of accepted value of RBE were used to calibrate the chamber and to check the calculated response. It is estimated that the chamber will measure the RBE of any mixture of radiation to within 20%. (auth)

27057 (MMPP-196-2) WAVELENGTH-DEPENDENT EFFECTS OF LOW-ENERGY X-RAYS ON MAMMALIAN TISSUE CELLS (thesis). Walter Frederick Wegst, Jr. (Michigan. Univ., Ann Arbor. Michigan Memorial-Phoenix Project). 1963. Contract AT(11-1)-1205. 177p. (ORA-5222-1-T)

An investigation was made to determine if the radiation response of a mammalian cell is dependent on the wavelength of the impinging radiation. The survival of strain L cells, as measured by the dose in rads necessary to kill 25% of the cells, is shown to vary by a factor of ~3, between 5.41 and 5.90 kev. The survival of the cells, as measured by the dose in rads necessary to reduce the surviving fraction by 63% along the exponential part of the survival curve, is shown to vary by a factor of ~3.5, between 5.90 and 7.48 kev. Finally, the production of CO_2/mg of the precipitable cellular protein per unit dose is shown to vary by a factor of ~2, between 6.40 and 7.48 kev. The experimental evidence strongly suggests that certain metallic trace elements in the tissue cells are involved in producing the observed discontinuities in the radiation damage spectrum. In particular, the relative magnitudes of the depression of CO_2 production as a function of energy appear to parallel the relative magnitudes of the mass absorption cross section of the element iron. This may indicate that the cytochrome enzymes are involved in the radioinduced depression of CO_2 production. The relative magnitudes of the various methods of expressing cell survival as a function of energy seem to parallel the relative magnitudes of the mass absorption cross section of the element manganese. However, no hypothesis is postulated to explain this apparent relation between x-ray absorption in manganese and cell death. (auth)

27058 (NP-12897) ACCIONES BIOLOGICAS DE LAS RADIACIONES ATOMICAS. (Biological Effects of Atomic Radiations). M. A. Patetta-Queirolo (Uruguay. Universidad de la Republica, Montevideo). Feb.-Mar. 1959. 73p.

A résumé is presented of each class in a course on the biological effects of nuclear radiations. The topics discussed include the physical and chemical bases of radiation effects, primary and secondary processes, accumulated effects, biochemical and cellular effects, radiation effects on living organisms and tissues, radioecology, genetic effects, cytogenetic effects, genetics of radiation in mammals, response of mammals to irradiation, dosimetry, and protection against radiations. (J.S.R.)

27059 (ORNL-3457) THE DEPTH-DOSE DISTRIBUTION PRODUCED IN A SPHERICAL WATER-FILLED PHANTOM BY THE INTERACTIONS OF A 160-Mev PROTON BEAM. F. C. Maienschein and T. V. Blosser (Oak Ridge National Lab., Tenn.). July 10, 1963. Contract W-7405-eng-26. 44p.

Measurements were made of the total energy deposited at various points within a 42-cm-dia spherical water-filled lucite phantom by the secondary particles resulting from 160-Mev proton reactions with various targets. Target materials were water, aluminum, carbon, copper, and bismuth. Detectors were small lucite-walled ionization chambers filled with 97% A–3% CO_2 or ethylene gas. Data were taken both with the lucite phantom on the beam axis and with the phantom offset approximately 54°-43′ from the beam axis. The proton beam energy determined from a part of these results, 160-162 Mev, is in good agreement with published values. The energy deposited by secondary particles was found to increase with Z, as expected. The depth-dose curves obtained have a steeply negative slope over the region near the surface of the phantom and a more gentle slope at greater depths. The magnitude of the dose in the region of the initial slope decreases with increasing target thickness. The dose in this region is presumably due to secondary protons. The magnitude of the dose at greater depths increases with increasing target thickness. At the greater depths the slope of the depth-dose curves, presumably controlled by secondary neutron interactions, is similar to that observed when the depth dose due to a Co^{60} gamma-ray source was measured. A portion of the data is presented graphically and a complete tabulation of all results is included as an appendix. (auth)

27060 (SAM-TDR-63-17) RADIOPROTECTIVE AGENTS. A CORRELATIVE STUDY OF RNA CONTENT AND THE DEGREE OF RADIORESISTANCE OF CELLS IN VITRO. Donald E. Rounds and William C. Slick (Pasadena Foundation for Medical Research, Calif.). Mar. 1963. Contract AF41(657)-337. 5p.

In vitro studies revealed that a 24-hour preirradiation treatment of an amnion cell line with yeast RNA increased cell survival in proportion to the yeast RNA content in the medium. Conversely, ribonuclease treatment increased radiosensitivity. However, the protective response was observed only after 8 to 10 hours of preirradiation treatment with yeast RNA. Some increase in cell survival was recorded at 4 to 6 hours when an alkaline hydrolysate of yeast RNA was used. Microspectrophotometric measurements of cytoplasmic basophilia revealed substantially increased optical density within 4 hours of incubation with RNA. The delay in a protective response during this period may have been due to the time required for digestion and resynthesis into an active radioprotective agent. A correlation between RNA synthesis and the radioprotective response confirmed this hypothesis. (auth)

27061 (TID-18616) LABORATORY EXPERIMENTS IN RADIATION BIOLOGY. Edward I. Shaw (Kansas. Univ., Lawrence). Feb. 1963. Contract AT(11-1)-1093. 150p.

A set of experiments from which several may be selected for use in courses for advanced high school and beginning college students is provided. These experiments may be used to demonstrate the operation of fundamental

principles without requiring extensive or costly specialized equipment. Subjects discussed include special techniques and the preparation of special equipment useful in performing experiments, characteristics of radiation detection instruments, interaction of radiations with matter, methods of measurement of radiation and assay of radioactivity in various materials, and radioactive tracer experiments and experiments on the biological effects of radiation. (P.C.H.)

27062 (TID-18722) [DOSIMETRY IN HUMAN RADIOEPIDEMIOLOGY WITH SPECIAL REFERENCE TO SKELETAL DOSE RATES IN THOROTRAST CASES]. Second Progress Report. (International Atomic Energy Agency, Vienna). [1962]. Contract AT(30-1)-2819. 6p.

Progress is reported in a study on the magnitude of skeletal dose rates resulting in humans from Thorotrast burdens. Facilities for dosimetry measurements were completed. A bibliography of about 1500 references to Thorotrast and related subjects was completed. Whole-body measurements were made on 2 Thorotrast cases and several normal persons. (C.H.)

27063 (TID-18846) NUCLEOLAR RESPONSES TO IONIZING IRRADIATION. P. O'B. Montgomery, D. H. Karney, and R. C. Reynolds (Texas. Univ., Dallas. Southwestern Medical School). [1963]. Contract AT (40-1)-2478. 8p.

Chang liver cells were x irradiated and then examined by electron micrography approximately 25, 40, 50, 60, 70, and 168 hr later. Radioinduced changes in the nucleoli do not relate to an orderly time sequence and the same type changes were found in all of the cultures studied irrespective of the time after or amount of x irradiation. Types of changes found are designated as nucleolar doughnut, nucleolar mosaics, a combination of the nucleolar doughnut and mosaic patterns, and nucleolar synechiae. Descriptions of each type change found are given. (P.C.H.)

27064 (TID-18855) STUDIES OF MUTATION AND OF RECOMBINATION IN THE SAME CHROMOSOMES OF IRRADIATED FEMALE DROSOPHILA MELANOGASTER. Final Report, Feb. 1, 1954–March 31, 1963. Maurice Whittinghill (North Carolina. Univ., Chapel Hill). Contract AT(40-1)-1740. 34p.

The frequency of new lethal mutations was measured in chromosomes from isogenic sources which marked the whole length of the second chromosome pair of Drosophila melanogaster for the detection of crossovers simultaneously. Control heterozygotes and sisters given x-ray doses of 3666 or 4580 r provided chromosomes tested by the Sifter technique of Müller. Thereafter, each recessive lethal was further tested to determine the location of the new lethal, particularly as to whether it was in a region of crossing over or was outside any nearby region of exchange. In the chromosomes of eggs layed in the first 10 days postirradiation the frequency of new recessive lethals decreased from a high of 9.8 ± 1.11% in the first four day period to 4.7 ± 0.74 in the last three day period. These same chromosomes showed an increase in crossover chromosomes available for testing, but only during the second and third breeding periods. Neither the crossovers nor the lethals were linearly related to dose. Four-fifths of the higher dose received during $^4/_5$ of the maximum time of treatment produced less than $^4/_5$ of the crossover frequency and of the lethal frequency of the 4580 r group. In spite of the two parameters changing in different directions with time the contingency Chi square showed an excess of chromosomes both lethal and crossover in the same region only in the spindle region and in a mid arm region. Studies were made of the mean viability and of its variability among the many nonlethals and lethals of the experiment. Viability was less after either of the irradiation doses. Variability was greater, as expected, among irradiated chromosomes and among crossover chromosomes. The immediate vicinity of the spindle attachment is evidently a very special region of the chromosome in regard to its responses to externally administered irradiation. (auth)

27065 (UCRL-10724) CRYSTALLINE LUMINESCENCE OF CELL-NUCLEAR CHEMICALS UNDER IONIZING RADIATION (thesis). Richard Lawrence Lehman (California. Univ., Berkeley. Lawrence Radiation Lab.). Mar. 14, 1963. Contract W-7405-eng-48. 83p.

An experimental study was made of the delayed phosphorescence and thermoluminescence properties of 34 separate cell-nuclear chemicals exposed as crystalline powders to cobalt-60 rays at 77°K. In addition, the luminescence of the nucleic acid bases and related compounds was studied under irradiation with intense heavy-ion and electron beams. Under electron bombardment, the effects of ambient gases at various pressures were examined at 77 and 295°K. The biological significance of these measurements is discussed. The thermoluminescence-glow peak location, temperature-widths, and yields are reported. The location in no case exceeded 180°K, and in most cases stood in the region 100 to 150°K. It was found that a given chemical may have several peaks, and similar chemicals may have glow peaks that differ in width, location, and intensity. Adenine and cytosine samples released 0.2 and 0.1%, respectively, of the absorbed gamma energy as thermoluminescence. In each case, the yields of molecular compounds that contained conjugated π-molecular orbitals approached these; other compounds such as lecithin had yields of the order of 10^{-7}. The activation enthalpies for thermoluminescence glows have been examined in detail, and a new method for their determination based on phosphorescence decay at 77°K has been used. For those substances exposed to the particle beams, the emission spectra and yields at 250 to 600 nm under various gas pressures have been reported. Radiofluorescence energy yields up to 13% were measured for adenine at 77°K when the ambient oxygen gas pressure was 300 μ Hg. At 286°K the yield was 0.2%. Yields for the other nucleic acid bases were roughly 1/10 of these. The emission spectra were found to be bell-shaped bands in the region 350 to 540 nm with widths of about 100 nm. When adenine was exposed at 77°K in the presence of > 100 μ Hg of gas, the emission spectrum peaked at 490 nm. Under vacuum at 77°K, or at 286°K under all conditions, the spectrum peak shifted to 520 nm. Similar shifts were observed for the other compounds. A conceptual model, the exciton hypothesis, has been advanced to interpret the temperature and gas pressure effects on radioluminescence. (auth)

27066 (USNRDL-TR-640) INHIBITION OF THYMIDINE KINASE—DNA POLYMERASE ACTIVITY IN THE KIDNEY BY X-RADIATION BEFORE OR AFTER UNINEPHRECTOMY. R. K. Main, L. J. Cole, and E. R. Walwick (Naval Radiological Defense Lab., San Francisco). Apr. 23, 1963. 21p. (AD-405963)

Groups of rats were exposed to whole-body x radiation (850 rad) at various time intervals either before or after unilateral (left) nephrectomy, and the remaining (right) kidney was removed 48 hours postnephrectomy. The specific activity of the kidney enzymes (thymidine kinase-DNA polymerase system) catalyzing DNA-synthesis was then

assayed by measuring the incorporation of H^3-thymidine into DNA in vitro. The ratio of enzyme activity in right versus left kidney in each animal is termed the induction ratio. The induction ratio was profoundly suppressed in rats irradiated at 10 minutes to 18 hours after uninephrectomy (values < 1); when irradiated between 19 and 24 hours after unilateral nephrectomy there was a sharp and precipitous rise in the induction ratios (values up to 6.6). When radiation exposure was carried out between 15 minutes and 22 hours before uninephrectomy, the induction ratios were depressed (< 1, and as low as 0.05). The evidence suggests that partial recovery from this latent radiation damage can occur if the time interval between irradiation and uninephrectomy is sufficiently prolonged; when this interval was 20 days, induction ratios attained values of 4.4. The data indicate that the early steps in induction or formation of the thymidine kinase-DNA polymerase enzyme system are highly radiosensitive; that latent radiation-inducted damage to the enzyme-forming system occurs, i.e., when the radiation is applied before unilateral nephrectomy; that this enzyme system in the kidney may be continuously renewed, with a turnover time of less than 48 hours. (auth)

27067 (WP/22/5) NUCLEAR MEDICINE. A GUIDE TO RECENT LITERATURE. List No. 5. (International Atomic Energy Agency, Vienna). May 1963. 78p.

References are presented to recent publications in the field of nuclear medicine. (C.H.)

27068 (CEA-tr-R-1678) STIMULATION DE LA CROISSANCE DE LA RACINE DES PLANTES DE LA FAMILLE DES CHENOPODIACEES, DES CRUCIFERES ET DES OMBELLIFERES DANS DES SOLS DE TOURBIERE ET MINERAUX, PAR LES RAYONNEMENT γ DU RADIUM, DU COBALT ET PAR LES RAYONS X. (Stimulation of the Growth of the Roots of Plants of the Chenopodiaceae, Cruciferae, and Umbelliferae in Soils of Peat and Minerals by Radium and by X Rays). A. S. (C.) Palamarchuk. Translated into French from Ukr. Botan, Zh., 17: (1960). 27p.

The effect of Co and Ra γ rays and x rays at different levels of exposure on the formation of the root of plants of the Chenopodiaceae, Cruciferae, and Umbelliferae families was studied, and their development from different parts of the seed was evaluated by cultivating them in soils of peat and minerals. Under good cultivation conditions, the ionizing radiation stimulates the root formation and increases the harvest 25 to 100%. Different exposures at the same radiation dose stimulate in different fashions the growth of seed parts. In the most frequent cases, a long irradiation exposure has the same effect as a higher dose. A long exposure is found to be more efficient than a short exposure when the cultivation conditions are good. Short-time exposure at the optimum radiation dose causes the appearance of teratological variation more often than extended exposures. Co γ rays have a more stimulating property on the formation of radish roots than x rays. Stimulation of the formation of the stem and of the production of leaves and seeds is caused by doses lower than those that stimulate root formation. Under good cultivation conditions for the root, the optimum stimulating doses for formation processes are, as a general rule, higher than those needed for poor cultivation conditions. The growth of different parts of the seed, from which the root is formed, is often stimulated by different radiation doses. (tr-auth)

27069 (JPRS-19284) CERTAIN PROBLEMS OF THE EFFECT OF IONIZING RADIATION ON THE NERVOUS SYSTEM. M. M. Livanov. Translated from p.24-47; 174-7; 195-6 of "Nekotorye Problemy Deystviya Ioniziruyushchey Radiatsii na Nervnuyu Sistemu," 1962, Moscow. 44p. (OTS-63-21865)

Mechanisms of direct and indirect effects of radiation on the central nervous system are discussed. Data are reported from studies on the induction of ulcers in rabbits by irradiation of the extremities and changes in electrical response of the brain to direct and whole-body irradiation. (C.H.)

27070 (JPRS-19806) THE PROBLEM OF THE IRRITATING EFFECT OF IONIZING RADIATION. K. Sh. Nadareyshvili. Translated from Soobshch. Akad. Nauk Gruz., 30: 213-20(1963). 12p. (OTS-63-31095)

X irradiation of various topographic anatomical areas of the body of rabbits, at a definite gradient of dose strength, manifested characteristics of an irritating agent in regard to certain physiological functions. Upon combination of a brief action of x rays with electrocutaneous irritation, it was possible to develop defensive conditioned reflexes to the radiation effect in total irradiation, as well as in local irradiation of the head and abdominal area. Following a total dose of fractional action of x rays equalling 50 r and more in total irradiation, and 1000 r or more in local irradiation of the head, the electro-defensive reflexes were sharply reduced or disappeared completely, regardless of whether the electrocutaneous reinforcement was continued or terminated. (P.C.H.)

27071 (OTS-62-11755/2(p.99-100)) THE EFFECT OF X-RAY RADIATION ON SOME BIOLOGICAL CHANGES IN SOYBEANS. A. Mitrović, M. Šuput, and M. Mihajlović. Translated from Arhiv Poljoprivredne Nauke, 15: No. 48, (1962).

The effects of irradiation of seed of soybeans on the biological characteristics and chemical composition of kernels were investigated. Doses of x radiation below 9000 r increased the yield of kernels and increased the oil content of kernels, while high doses caused a reduced yield. Irradiation caused a reduction in protein content of the kernels. (C.H.)

27072 THE INFLUENCE OF RADIOACTIVE PHOSPHORUS (P^{32}) ON THE GROWTH AND DIFFERENTIATION OF THE TADPOLES OF RANA TEMPORARIA. I. G. Russu, T. Holan, A. Rosenberg, and L. Diacu (Faculty of Medicine, Cluj, Rumania). Acta Anat., 46: 233-9(1961). (In German)

Histochemical studies were conducted on tadpoles reared from eggs in water containing 100 to 1500 mC P^{32}-phosphate. At the highest dose the first detectable change was decreased RNA-staining granules and increased vacuolation of the yolk. The cell nuclei of the neural tube showed bluish staining with methyl green-pyronin rather than the greenish color of controls. The liver showed marked changes, including atrophy and uneven thickness of liver cell trabeculae, granulated or vacuolated parenchymal cells, and absence of RNA in their cytoplasm. Nuclei showed irregular staining and pyknosis. Regressive changes were found in the thyroid. Other organs also showed atrophic alterations. Growth of the animals was retarded, their motility was depressed, and death occurred with the highest doses. It is suggested that many of the changes can be attributed to impairment of protein synthesis presumably as a result of a primary action of P^{32} on DNA and RNA replication. The cytoplasm rather than the nucleus appears to be the site of initial action of P^{32}, and injury to

cytoplasmic enzyme systems may be of basic importance in its action. (H.H.D.)

27073 EFFECT OF CELL-FREE SPLEEN EXTRACT ON BONE MARROW MEGAKARYOCYTES OF IRRADIATED GUINEA-PIGS. Preliminary Report. Joseph B. Johnston, Jr. and Thomas A. Strike (National Naval Medical Center, Bethesda, Md.). Acta Haematol., 28: 194-7(1962).

Megakaryocytic recovery was studied on the 9th post-irradiation day in spleen-extract-treated guinea-pigs and in saline controls following 650 r ($LD_{75/30}$) whole-body Co^{60} gamma radiation. An accelerated regeneration of these cells was found in the extract-treated group. Centers of active megakaryocytic regeneration were observed in the marrow of animals in both groups. The incidence of these centers correlated well with survival in the two groups. Accelerated megakaryocytic regeneration appears to be one of the mechanisms by which cell-free spleen extract may reduce radiation mortality. (auth)

27074 CHANGES IN INTESTINAL MICROFLORA IN X-IRRADIATED RATS. Jozef Kubica, Barbara Bukowska, and Zofia Cichowlas (Wojskowy Inst. of Hygiene and Epidemiology, Warsaw). Acta Microbiol. Polon., 11: 111-18 (1962). (In Polish)

Transistory bacteremia and intestinal microflora in x-irradiated rats were studied. Rats were subjected to total-body doses of 900 r and killed at different times after irradiation. Liver, spleen, and kidney were examined for presence of bacteria, and fecal material from jejunum, colon, and cecum was also used for bacteriological examination. From the internal organs of the irradiated rats, Escherichia coli and Proteus bacteria were isolated 4, 6, and 7 days after irradiation. The same bacterial strains were found in the intestines. This suggests that the presence of bacteria in internal organs was caused by the auto-infection from the intestine. The qualitative changes of intestinal microflora are described. The most distinctive changes were observed in the jejunum of irradiated animals. The ascendence of E. coli and Clostridium species into jejunum was noted; at the same time Streptococcus faecalis became rare. Sensitivity to antibiotics of the isolated strains was determined. (H.H.D.)

27075 THE VALUE OF OVARIAN IRRADIATION IN THE MANAGEMENT OF BREAST CANCER. M. P. Cole (Christie Hospital and Holt Radium Inst., Manchester, Eng.). Acta Unio Intern. Contra Cancrum, 18: 922-7 (1962). (In English)

A report is given of a clinical trial to assess the value of ovarian radiation (x-ray artificial menopause) for breast cancer. There appeared to be a definite advantage to cases having ovarian irradiation prophylactically as judged on crude survival rate. This improvement was more apparent in the earlier case than the late, with a definite decrease in the incidence of metastases in the treated group at 5 years. (auth)

27076 MINIATURE TISSUE EQUIVALENT IONIZATION CHAMBERS AND THEIR USE. F. W. Chambers, Jr. (Naval Medical Research Inst., Bethesda, Md.). Aerospace Med., 34: 193-6(Mar. 1963).

The design and application of miniature ionization chambers, particularly for evaluating the interaction of tissues with space radiations, are discussed. The design criteria for the chambers encompasses both small size and tissue equivalence, with a dose range of a few rads to several hundred rads. One design of a chamber 1.5 cm in diameter and 2 cm long is illustrated. The wall, inner electrode, and base are composed of elements representative of the tissue of interest. It is possible to compound plastics to simulate bone, fat, and muscle. Since the ionization chamber is essentially a capacitor, some parts are made of a high-grade insulating material such as Kel-F or polystyrene. When the chamber is assembled, there is a void in the cap that is filled with a gas that is similar, in elemental composition, to the wall of the chamber. The chambers are sealed to retain the gas. A system was developed in which 3 chambers are sealed in a tube. The chambers are prepared for use in a hood containing the tissue-equivalent gas atmosphere. After they are irradiated, the amount of exposure is determined by the use of an electrometer. The difference in response of the chambers when they are filled with a gas other than air, and exposed to photons of different energies, is illustrated. Three different mixtures of argon and methane were used so that the atomic number (Z) would approximate that of bone, muscle, and fat. To determine the tissue dose distribution in biological objects or suitable phantoms under given exposure conditions, the chambers were placed at various points in either the biological object or a suitable phantom containing a tissue-equivalent fluid. Three different size phantoms designed to be representative of the range of human torsos are shown and dose distribution in a Co^{60} field was determined. (TCO)

27077 EARLY EFFECTS OF RADIATION ON RENAL FUNCTION IN MAN. Louis V. Avioli, Michael Z. Lazor, Ernest Cotlove, Kirkland C. Brace, and J. Robert Andrews (National Cancer Inst., Bethesda, Md.). Am. J. Med., 34: 329-37(Mar. 1963).

Studies were undertaken in 10 patients with abdominal neoplasms in order to define alterations in specific renal functions (glomerular filtration rate (GFR), renal plasma flow (RPF), and tubular excretory capacity) as well as the more commonly used indicators of renal status before, during, and following therapeutic abdominal radiation with 2-Mev x rays. All patients had normal renal function prior to irradiation. The most significant renal effect of irradiation was on RPF, which fell progressively during radiotherapy, beginning at 400 rad. It proved to be the most sensitive and consistent index of radiation damage. Transient depressions in GFR at 400 rad were followed at 550 to 1625 rad by increases above the initial values before radiation. At cumulative therapeutic dosages of 2000 to 2400 rad a progressive decrease in GFR was observed that has persisted up to 12 months after radiation. Tubular function, measured as the maximum excretory capacity for p-aminohippuric acid (Tm_{PAH}), was more variable but a major trend was a decrease during and following radiation. No definite alterations were observed in the results of commonly employed laboratory tests of renal function during and following the radiation period. In contrast to the reported effects of radiation on the kidneys of animals, a reduction in RPF was the most consistent finding in man. It was tentatively concluded that the observed derangements in renal function following abdominal radiation resulted from the direct effects of x rays on the kidney. (TCO)

27078 SUBACUTE ILEUS OF THE SMALL INTESTINE: STENOSIS OF THE ILEUM AS A RESULT OF IRRADIATION; A RADIOLOGIC STUDY. V. Hoffmann (Universitäts-klinik, Cologne). Arch. Klin. Chir., 298: 459-68(1961).

Seven cases of intestinal obstruction as a result of pelvic radiotherapy are described. In all cases the resected damaged segment of ileum showed characteristic changes. In one case a penetrating abcess was found, with development of an enterovaginal fistula. For such an injury, a 6000 mr-hr dose of Ra appears to be required. Ileus

developed in said cases between ½ and 11 yr after radiotherapy. The syndrome is described. Treatment consists of surgical removal of the constricted segment. Radiologic diagnosis of radiation-induced ileus is discussed. (H.H.D.)

27079 EFFECTS OF ULTRAVIOLET LIGHT ON THYMIDINE DINUCLEOTIDE AND POLYNUCLEOTIDE. R. A. Deering and R. B. Setlow (New Mexico Highlands Univ., Las Vegas and Oak Ridge National Lab., Tenn.). Biochim. Biophys. Acta, 68: 526-34(Apr. 30, 1963). (In English)

The absorbance changes in dithymidylic acid and in polythymidylic acid produced by ultraviolet irradiation have been interpreted in terms of the reversible formation of dimers between adjacent thymine residues. The formation of dimers, breakage of dimers, and steady-state fraction of dimers are all wavelength dependent. The action spectra for dimer formation are approximately the same as the absorption spectrum of thymine. The quantum yields are approximately 0.01 for dithymidylic-acid and approximately 0.02 for polythymidylic acid. The action spectra for dimer breakage are the same for both polymers and are similar to that for breaking the thymine dimer. The quantum yield is approximately 1. The steady-state fraction of dimers is approximately 70% for 280 mμ and approximately 15% for 240-mμ irradiation. (auth)

27080 ULTRAVIOLET INACTIVATION OF DNA PRIMER ACTIVITY. I. EFFECTS OF DIFFERENT WAVELENGTHS AND DOSES. F. J. Bollum and R. B. Setlow (Oak Ridge National Lab., Tenn.). Biochim. Biophys. Acta, 68: 599-607(Apr. 30, 1963). (In English)

The ability of denatured DNA to act as a primer for enzymic DNA synthesis is lowered drastically by ultraviolet irradiation of DNA in either native or denatured form. Radiation of 280 mμ is more effective than 239 mμ and the effects of 280 mμ irradiation are partially reversed by 239 mμ. These results suggest that the lesions produced in DNA by ultraviolet light are dimers between adjacent thymines. Priming activity does not fall to zero upon ultraviolet irradiation but, for high AT DNA's, levels off at about 10% of its initial activity. The product produced from these irradiated primers has a higher G/A ratio than that made from unirradiated primer. These results are interpreted on a model that takes into account the nature of the priming reaction and suggest a possible mechanism for the mutagenic action of ultraviolet light. (auth)

27081 CAVERNOUS ANGIOPLASTIC ENDOTHELIAL SARCOMA OF THE LIVER AND HEPATIC THOROTRASTOSIS. A. Batzenschlager, P. Reville, and M. Weill-Bousson (Faculté de Médecine, Strasbourg). Bull. Assoc. Franc. Etude Cancer, 48: 347-64(July-Sept. 1961).

The case history is described of a 31-yr-old man who died of sarcoma of the liver 17 yr after diagnostic arteriography employing Thorotrast. Evidence is provided that development of the tumor can be attributed to Thorotrast. The tumor was not metastatic but occupied a large part of the liver. ThO_2 could be demonstrated in fibrotic portions of the tumor, throughout the liver, and in reticuloendothelial cells in the spleen, lymph nodes, and other tissues. Para-arterial deposits of ThO_2 were also seen and the condition was considered to reflect generalized thorotrastosis, including thorotrastic cirrhosis. Clinically, the tumor appeared to develop over a 4-yr period, causing irreparable hepatic insufficiency. The tumor was of mesenchymal nature with an angiomatous structure. It was formed from endothelial elements of liver sinusoidal capillaries. Eleven other cases of thorotrastomas reported in the literature are reviewed. The average time between introduction of Thorotrast to detection of the tumor is 13 yr. The rare nature of the neoplasia, its constant association with ThO_2, and the known carcinogenic action of ionizing radiation appear to implicate Thorotrast in the development of these tumors. (TCO)

27082 EFFECT OF ACIDOPHILUS MILK ON GUINEA-PIGS EXPOSED TO X-RAYS. K. Tomić-Karović. Bull. Sci., Conseil Acad. RPF Yougoslavie, 7: 163-4(Dec. 1962). (In English)

Irradiated suckling guinea pigs maintained on a diet of acidophilus milk developed better and gained weight more rapidly than controls. It is pointed out that acidophilus milk contains considerable amounts of folic and folinic acid and that both these acids belong to the group of B-complex vitamins. The role of these vitamins in the protection of cells against radiation injury is discussed. (C.H.)

27083 INFLUENCE OF ACIDOPHILUS MILK ON YOUNG OF GUINEA-PIGS IRRADIATED WITH X-RAYS. K. Tomić-Karović. Bull. Sci., Conseil Acad. RPF Yougoslavie, 7: 164-6(Dec. 1962). (In English)

The offspring of guinea pigs maintained on acidophilus milk after irradiation in infancy and mated to non-irradiated pigs were normal and grew well. The offspring of irradiated litter mates maintained on normal diets included many abnormal young that exhibited impaired growth. Results indicate that the folic and folinic acids in acidophilus milk may protect the gonads against radiation. (C.H.)

27084 THE EFFECT OF X-IRRADIATION ON THE CHROMIUM-51 CONTENT OF LIVER NUCLEIC ACIDS AND PROTEINS. P. V. Vittorio and E. W. Wight (Defence Research Chemical Labs., Ottawa). Can. J. Biochem. Physiol., 41: 1349-51(June 1963). (DRCL-397)

When tracer amounts of sodium radiochromate were injected intraperitoneally into mice, x irradiation (600 r) produced an increase in the Cr^{51} content of the liver which was accompanied by an increase in the Cr^{51} content of the liver proteins and nucleic acids. The liver proteins and nucleic acids from the x irradiated mice both showed the greatest increase in Cr^{51} content at 16 days but at 37 days the x irradiated and non-irradiated values were fairly similar. It is suggested that the Cr^{51} content of the liver or liver proteins can be used as an index of repair or recovery following injury by x irradiation. (auth)

27085 EFFECT OF IONIZING RADIATION ON THE PYRIDINE NUCLEOTIDES OF THYMOCYTES. J. F. Scaife (Defence Research Chemical Labs., Ottawa). Can. J. Biochem. Physiol., 41: 1469-81(June 1963). (DRCL-402)

The pyridine nucleotides of thymocytes were examined following irradiation of the cells in vivo or in vitro. Nicotinamide-adenine dinucleotide (NAD) was found to constitute about 95% of the total oxidized pyridine nucleotides in thymocytes while the level of $NADH_2$ was found to be very low. There is a rapid loss of NAD from thymocytes following irradiation in vitro or in vivo which is evident with as little as 25 rads. There is no concomitant rise in the $NADH_2$ levels following irradiation. The loss of NAD occurs principally from the nucleus of the cell and is characterized by an intracellular release of NADase from the mitochondria and nucleus into the cytoplasm. Following irradiation there is a reduced capacity for thymocytes to synthesize NAD from 7-C^{14}-nicotinamide either in vitro or in vivo. The administration or presence of nicotinamide produces an unphysiological increase in the level of NAD in whole thymus or thymocytes in suspension. The level of

NAD in treated cells is higher than in untreated controls following irradiation. This effect is not produced by nicotinic acid, cysteamine, L-cysteine, or promethazine. The administration of nicotinamide does not prevent the development of pyknotic degeneration in irradiated thymocytes. There is no change in the RNA content of the thymus under the conditions which reduce the NAD content. (auth)

27086 EFFECT OF IONIZING RADIATION ON THE OXIDATION OF SUCCINATE BY RAT THYMUS MITOCHONDRIA. J. F. Scaife (Defence Research Chemical Labs., Ottawa). Can. J. Biochem. Physiol., 41: 1486-90 (June 1963). (DRCL-399)

Possible mechanisms involved in the lethal effects of x radiation in thymocytes were investigated. Results are reported from measurements of succinate-tetrazole reductase activity of thymus from normal and irradiated rats. Evidence was found for a soluble cofactor necessary for succinate reductase activity. The role of the electron transport chain in the radiosensitivity of enzyme systems in thymus mitochondria is discussed. (C.H.)

27087 EFFECT OF IONIZING RADIATION ON THE ROOT TIPS OF AVENA STERILIS (2n = 42). Giuseppe Martinoli and Laura Bagnoli (Università, Pisa, Italy). Caryologia, 15: 327-33(1962). (In Italian)

Chromosomal anomalies observed after x irradiation of the germinating seeds with 100, 250, and 500 r were compared with those previously observed in other Avena species with lower chromosome numbers (A. strigosa, 2n = 14 and A. barbata, 2n = 28). Agglutination of chromosomes was frequently observed, with consequent prolongation of the duration of metaphase and compression of the proximal portion (centromeric region) of the chromosomes. Acentric fragmentation of chromosomes and formation of ring or cyclic chromosomes were also noted. Disorders in the formation of the spindle were evident in anaphase as well as in metaphase, which were accompanied by errors in spiralization and spurious breakage. Development of micronuclei by a group of chromosomes undergoing retarded division was also seen. In contrast to results of earlier studies with Avena species having fewer chromosomes, it was difficult to observe inversions, translocations, and deletions of single chromosomes. (H.H.D.)

27088 ACTION OF RADIATION ON CELLULOSE AND PLANT STRUCTURAL SUBSTANCES. Hans Lueck and Friedrich Dell (Deutsche Forschungsanstalt für Lebensmittelchemie, Munich). Chimia (Aarau), 17: 1-8(Jan. 15, 1963). (In German)

Changes induced by ionizing radiation in cellulose, hemicellulose, lignin, and pectin are discussed. Doses above 1 Mrad caused a marked degeneration of cellulose, especially a splitting of the 1,4-β-glucosyl bond. Carbonyl and, to a smaller extent, carboxyl groups were formed. Numerous breakdown products appeared such as mono- di- and oligosaccharides, cellulodextrins, acids (2-ketogluconic acid and its lactone, 2-ketocellobionic acid), reductones, and gases ($CO > CO_2 > H_2$). Irradiated cellulose was more sensitive to the action of cellulase, cellulose-splitting microorganisms, and acid hydrolysis. Of various cellulose derivatives tested for polymerization under high radiation doses, carboxylated cellulose was not polymerized, but the methyl, hydroxyethyl, and methylhydroxybutyl derivatives were polymerized by high doses. At higher doses, oxidations and splitting off of the substituents occurred. Polymerization reactions were favored by a low viscosity of the medium, while degradation reactions predominated in a high-viscosity medium. Lignin, which has a protective effect on cellulose, was less sensitive to irradiation than cellulose. Hemicelluloses were much easier to degrade than cellulose. Pectins too, especially protopectins, were very sensitive to ionizing radiation when doses surpassed 0.01 Mrad. On the other hand, pectin jellies made from sugar, acid, and pectin were affected only by doses above 1 Mrad. (H.H.D.)

27089 STUDIES ON THE PROBLEM OF THE IMMEDIATE DETECTION OF THE BIOLOGIC ACTION OF ROENTGEN RADIATION. [PART] 3. R. Schuppli and H. H. Wagener (Dermatologisches Universitäts-Klinik, Basel). Dermatologica, 126: 246-52(1963). (In German)

Previous studies indicated that conductivity of the skin is immediately decreased after irradiation. Further studies on this phenomenon were conducted in rabbits, using x rays of 10, 20, 37, 55, and 100 kv. The dose rate with all intensities varied between 380 and 495 r/min; the tissue half-value depth varied from 0.02 mm at the lowest intensity to 11.0 mm at the highest; and the total surface dose in all cases was 1000 r. It was shown that the rate of decrease of cutaneous conductivity was almost linearly proportional to the hardness of the radiation. This change paralleled the tissue half-value depth and the percentage of the surface dose reaching a depth of 0.5 mm. Only at the lowest intensity was a linear relation not obtained. The possibility that this decline in conductivity induced by radiation may be because of depolymerization of mucopolysaccharides in the skin is suggested. Contrary to expectations, injection of cysteamine 12 min before irradiation actually increased the rate of decline of skin conductivity. When doses of 40, 100, or 150 mg/kg were injected intravenously in the rabbits before 5000-r irradiation, the decline was greater with the increasing dose level. This finding is in contrast to earlier results which showed that the decrease in the injection pressure in skin immediately after irradiation is inhibited by cysteamine treatment. (H.H.D.)

27090 THE INFLUENCE OF GERM CELL STAGE ON REPRODUCTIVE AND GENETIC EFFECTS OF RADIATION IN MAMMALS. E. F. Oakberg (Oak Ridge National Lab., Tenn.). Diseases Nervous System, 24: 6p. (Apr. 1963).

The type and frequency of radiation induced genetic effects observed vary significantly between cell types. Quantitatively, the range is from small differences to those which are so large that they suggest qualitative effects. Dependence of mutation frequency on dose rate also is affected by cell stage, being demonstrable in spermatogonia and oocytes but not in spermatozoa; furthermore, the magnitude of this effect is larger in oocytes than in spermatogonia. Cell stage also affects the sensitivity to cell killing, and though this appears to depend upon different mechanisms from those involved in mutation production, cell populations are altered both in number and frequency of different stages, and these changes may yet prove to influence the detectable mutation frequency. Finally, extrapolation of results of experiments on radiation genetic damage from one species to another must take into account the possible effect of the primary cell stages involved. In the male, this is relatively straightforward since spermatogenesis is basically the same in all animals, and correction need only be made for duration of gametogenesis. A different situation obtains in the female, however, and evaluations of relative genetic damage must consider the possibility that different cell stages are being compared. (auth)

27091 THE PHYSIOLOGICAL EFFECT OF POLLEN IRRADIATED WITH X RAYS ON THE SELF-FERTILIZATION OF CORN. E. A. Britikov and Z. V. Lebedeva

(Timiryazev Inst. of Plant Physiology and Genetics, Academy of Sciences, USSR). Dokl. Akad. Nauk SSSR, 149: 460-3(Mar. 11, 1963). (In Russian)

The sperm of a corn plant can be sterilized by a definite dose of x rays, while the pollen tubes continue to grow and can be used to study the physiological effect of a pollen mentor in the cross-fertilization of corn. Pollen from B41 corn was given x-ray doses of 0, 5, 15, 35, and 50 kr. The irradiated pollen was mixed in a volume ratio of 1 : 4 with the pollen of the parent hybrid IGAN-1 which was being self-fertilized. Careful isolation conditions were maintained. The results showed that the addition of B41 pollen stimulates growth in the IGAN-1 hybrid. An optimum dose of 15 kr to the B41 pollen gave a 184.7% increase in grain content compared to pure self-fertilization, which approached the yield obtained by an inter-variety pollination of unirradiated pollen (202.7%). A lower dose of 5 kr gave a yield of 163.3%, while doses of 35 and 50 kr gave yields of 135.3 and 140.7%. Two lines of the B41 (Bezenchukskaya 41) variety were selected as the parents, and irradiated pollen from these plants were used as mentors. The stimulation in growth was somewhat higher (35.9% higher for a dose of 15 kr). Thus, x rays can be used not only to produce haploids and mutants, but also can be used to study the physiology of a pollen mentor for use in plant selection. (TTT)

27092 APPLICATION OF RADIOISOTOPES TO AGRICULTURE. J. M. Gamboa Loyarte and N. Ortin Suñe. Energia Nucl. (Madrid), 6: 45-66(Oct.-Dec. 1962). (In Spanish)

The use of radioisotopes in agricultural investigations is reviewed. The topics discussed are the biological effects of radiations on plants, radioisotopic study of soil physics, and tracer studies. 96 references. (J.S.R.)

27093 A CHROMOSOME STUDY OF RADIATION SENSITIZATION BY 5-BROMODEOXYURIDINE. Carolyn E. Somers and R. M. Humphrey (Univ. of Texas, Houston). Exptl. Cell Res., 30: 208-17(Mar. 1963).

Mammalian cells grown in vitro were utilized to study radiosensitization following 5-bromodesoxyuridine (BUDR) treatment. Maximum radiation sensitivity of BUDR treated and untreated cell populations, measured in terms of chromosome damage, was found in metaphase cells sampled at the first mitosis following irradiation. A nonrandom distribution of chromatid breaks was found in chromosome No. 1 of Chinese hamster cells treated with BUDR prior to irradiation. A cell line, derived from strain L of the mouse, resistant to BUDR did not show maximum radiosensitivity. (auth)

27094 PROTRACTED EFFECTS OF REPEATED DOSES OF X-RAY IRRADIATION IN RATS. C. C. Berdjis (U. S. Army Medical Unit, Fort Detrick, Md.). Exptl. Mol. Pathol., 2: 157-72(Apr. 1963).

Histopathologic observations are reported for a relatively old group of Sprague-Dawley rats that survived repeated doses of partial- and whole-body x irradiation. The following doses were administered at 4-week intervals during a 6-month period to the 52 test rats: 3 × 350 r (whole-body), 1000 r (chest), 900 r (both kidneys), and 500 r (whole-body). Animals dying early were discarded and all other animals were autopsied at death or sacrificed when they were 24 to 27 months of age. Carcinogenesis was prominent: there were 4.6 tumors per animal in irradiated rats versus 1.3 in controls. Repeated irradiation appeared to be highly carcinogenic with a selective effect upon the endocrine organs and the related governing systems. Renal and testicular tumors accompanied by nephrosclerosis and arteriosclerotic lesions were especially frequent. A pluriglandular syndrome consisting of multiple endocrine adenomas, intimately related to gastrointestinal and genitourinary disorders as in man, was encountered in several animals. Carcinogenesis was associated with arteriosclerotic lesions and widespread atrophic changes. Shortening of the life span, mortality rate, in addition to variations in size, animal and organ weight were observed in all animals. (TCO)

27095 RESTORATION OF IRRADIATED CELLS BY THEIR INTERACTION AFTER IRRADIATION. Jarmila Petrová (Charles Univ., Prague). Folia Biol. (Prague), 9: 142-52(1963). (In English)

Post-irradiation restoration through the interaction of irradiated cells in close proximity to one another, previously observed in the filamentous algae zygnema after α, β, and γ irradiation, was studied in detail. This phenomenon was studied quantitatively in the unicellular algae mesotaenium and was fully confirmed. Various statistical tests demonstrated the high degree of significance of the results obtained after large doses of x rays for groups of two cells. It was found that if irradiated zygnema filaments and mesotaenium cells were placed in close proximity to control cells, preferably immediately after irradiation, they were largely or even completely restored. This phenomenon was also induced by placing irradiated cells in close proximity to one another. (auth)

27096 RADIATION PASTEURIZATION OF FRESH FRUITS AND VEGETABLES. T. A. Truelsen (Atomic Energy Commission Research Establishment, Risö, Denmark). Food Technol., 17: 101-3(Mar. 1963).

Use of pasteurizing doses of Co^{60} γ radiation to increase the stability of fresh strawberries, raspberries, cauliflower, tomatoes, and asparagus was tested. Only with strawberries was it possible to obtain a considerable increase in stability. For all products there appeared to be a close connection between grading for taste and texture. Strawberry samples irradiated with 100, 200, 300, or 400 krad showed, a few days after treatment, no significant differences in scores between treated and untreated berries. However, after storage for 8 days all of the irradiated samples were judged better, and after 14 days, only the samples given high doses of radiation still appeared to be in better condition. At this time, however, berries from all types of treatment were judged unacceptable. Raspberries exposed to 250 to 500 krad showed deterioration of taste and texture, but 4 days after the berries were exposed to 100 krad they were given better marks than controls. Cauliflower examples exposed to 300 krad were considerably darker in 24 hours, and after 27 days discoloration was very pronounced. Irradiation of tomatoes appeared to impair the formation of lycopene. Doses of 1000 krad in asparagus caused deterioration of both taste and texture, with best results at a radiation dose of 250 krad. Only in raspberries was it possible for the low doses later in the storage period to raise the taste marks above the level of those given untreated samples. However, the improvement was not sufficient for the increase in stability to be of practical importance. (TCO)

27097 CYTOLOGIC STUDIES OF VAGINAL EPITHELIUM AFTER IRRADIATION OF CERVICAL CARCINOMA. H. J. Spechter and O. Ruff (Universitäts-Frauenklinik, Tübingen, Ger.). Geburtsh. Frauenheilk., 23: 90(Jan. 1963).

Biopsies were taken for cytologic study at the appear-

ance of the carcinoma and at least 30 months after the beginning of radiotherapy. The extension of the cervical cancer exerted no effect on the pyknosis index. The results were classified according to the menstrual status of the patient, i.e., whether menstruating regularly, 1-5 yr postmenopausal, 6-10 yr postmenopausal, or 11 yr or more postmenopausal at the beginning of treatment. No relation between pyknosis index and recurrence of cancer was noted. In the 4th above-mentioned group, a 10% increase in superficial cells was noted 12 months after treatment, without any relation to the recurrence of cancer. It was suggested that this reaction may have been caused by scattered radiation acting on the adrenal cortex. In the other 3 groups only the effects of ovarian function on proliferation of vaginal epithelium were detectable. Radiation caused a decline in ovarian endocrine activity in these cases, resulting in a decrease in pyknotic cells. In the younger women the action of the adrenal cortex on vaginal cells was less marked because of the dominant action of ovarian hormones. The observed pyknosis index did not provide any prognostic information or reflect the extension of cancer. (H.H.D.)

27098 TEST FOR SEX-LINKED LETHALS IN IRRADIATED MICE. C. Auerbach, D. S. Falconer, and J. H. Isaacson (Inst. of Animal Genetics, Edinburgh). Genet. Res. (Cambridge), 3: 444-7(Nov. 1962).

Attempts to devise a method for detecting sex-linked lethals in irradiated mice are described. Results are reported for 79 Tabby males irradiated with doses of 500 or 600 r and mated to females heterozygous for Bent-tail and Brindled in coupling. No sex-linked lethal was found but one sex-linked visible, a recessive anemia, was found. It was concluded that the difference in chromosome number accounts for the difference in induction of recessive lethals in irradiated Drosophila and mice. (C.H.)

27099 RATES OF FORWARD AND REVERSE MUTATION IN DROSOPHILA AFTER EXPOSURE TO MUSTARD GAS AND X RAYS. F. H. Sobels (Leiden State Univ.). Genetica, 33: 31-44(1962).

No indication for mutagen-specific differences in mutational responses was observed in Drosophila treated with mustard gas or x radiation. After treatment with mustard gas a higher ratio of visibles to lethals was observed than after exposure to x radiation. It is pointed out that comparisons of the mutagenic effect of a chemical mutagen with that of x radiation, even if restricted to visible mutations, inevitably involve an underestimate for the chemical, due to delayed effect. The observation that after treatment with mustard gas half the reversions arose by delayed effect supports the idea that the back mutations were not of spontaneous origin only. (C.H.)

27100 THE CHIMERICAL STRUCTURE OF A SOMATIC SOLANUM MUTANT REVEALED BY IONIZING IRRADIATION. Aage Heiken and Goeran Ewertson (Uppsala Univ.). Genetica, 33: 88-94(1963). (In English)

The possibility of demonstrating the chimerical structure of somatic mutants in Solanum tuberosum by means of ionizing irradiation was investigated. A somatic subdivided-leaf mutant of the variety President was studied. This mutant was isolated in 1957 and shown to remain stable during five years' propagation. Eye-excision experiments, in which 50 tuber halves were tested, failed to demonstrate the chimerical structure. Fifty tuber halves of the subdivided-leaf type were x irradiated with a dose of 4000 r. Five of the surviving 40 plants showed from 1 to 3 normal shoots. Furthermore, in one of these plants a few leaves were observed, one half of which was subdivided and the other normal. In the corresponding 50 unirradiated tuber halves, which served as controls, no morphological changes could be found. It is concluded that x irradiation is an efficient and easy method for revealing the chimerical structure of somatic mutants in S. tuberosum. It appears that the subdivided-leaf type is a periclinal chimera and that, as a result of x ray treatment, the mutant tissue in the exposed sprouts and/or eyes was destroyed (or physiologically inactivated) and the normal tissue was stimulated into producing adventitious buds from an underlying layer of cells. Moreover, in one instance the irradiation caused a morphological breakdown of the chimera resulting in a pronounced instability well-known from a number of the so-called leaf-deformity aberrants previously described. Thus the periclinal structure of the subdivided-leaf mutant appears fairly well established, but it is still unknown whether the mutant is a monochlamyde or a dichlamyde. (H.H.D.)

27101 CHARACTERISTICS OF OFFSPRING FROM TEN GENERATIONS OF X-IRRADIATED MALE MICE. J. F. Spalding, V. G. Strang, and W. L. LeStourgeon (Los Alamos Scientific Lab., N. Mex.). Genetics, 48: 341-6(Mar. 1963). (LADC-5278)

Breeding characteristics, as measured by litter data comparisons, of offspring of ten generations of x-irradiated sires were studied. Irradiated-line mice were found to be less efficient breeders than were control-line mice. The inheritance of radiation-induced deleterious recessive mutants and of lethal mutations was indicated. (auth)

27102 AN INFLUENCE OF MATERNAL NUTRITION UPON THE GROSS CHROMOSOMAL MUTATION FREQUENCY RECOVERED FROM X-RAYED SPERM OF DROSOPHILA MELANOGASTER. Irwin H. Herskowitz (St. Louis Univ.). Genetics, 48: 703-10(May 1963).

Undernourishment of females before, or before and after, they were mated and x rayed with about 3500 r significantly increased the rate of 2 to 3 reciprocal translocations recovered from the irradiated sperm chromosomes, as compared with the rate recovered from continuously well fed, otherwise comparable females. The rate of such paternal mutations increased (as much as 50 percent) in eggs successively oviposited by females that were undernourished before they were mated and irradiated. This increase occurred to a lesser extent, if at all, when the females were continuously well fed. The rate of complete or certain partial losses of a paternal sex chromosome (rod Y or rod X, or ring Y or rod X) increased about 300 to 600 percent in eggs successfully oviposited by females which were undernourished before and after they were mated and x rayed with about 3500 r. It is hypothesized that mutational enhancement by undernourishment is associated with some effect upon the joining of chromosome ends produced by breakage. (auth)

27103 THE ARREST OF INTESTINAL EPITHELIAL TURNOVER BY THE USE OF X IRRADIATION. G. Wiernik, R. G. Shorter, and B. Creamer (St. Thomas's Hosp., London). Gut, 3: 26-31(Mar. 1962).

Mitotic activity and cell turnover were abolished by local 1000 r x irradiation of segments of rat gut. The whole stomach, ascending colon, and 5 cm of jejunum and ileum were irradiated and the changes were observed histologically for 3 days. Cessation of cell turnover in the small intestine was followed by cell death and desquamation within 24 hr, leading to denudation of the epithelium and collapse of villous structure. The pylorus and colon showed similar but less marked changes. In contrast, the fundus and body

of the stomach were unaffected by the absence of mitosis over a 3-day period. Hence, irradiation appeared to have strikingly different effects in various parts of the gastrointestinal tract. In all areas mitotic activity was almost totally abolished by 1000 r. Throughout the gut there was no histological evidence of vascular damage attributable to the irradiation. Wherever epithelial changes occurred, an inflammatory exudation was seen, the cellular components of which consisted mainly of histiocytes and eosinophil leucocytes. The results show a difference in the potential cell life in various areas. When mitosis is stopped, the continuous migration of cells presumably ceases. The epithelial cells of the body of the stomach appear to remain viable up to 3 days whereas in the small intestine and pylorus the older cells are dead within 1 day, and all the cells are necrotic within 2 days. This suggests that in the healthy small intestine the cells are at the end of their life when they have reached the extrusion zones whereas in the body of the stomach this is not the case. In the colon the cells appear to have at least an extra day of life ahead when they reach the extrusion zones. There is a difference in behavior of the dead or dying cells in various areas. Shedding from the basement membrane generally occurs but is strikingly apparent in the small intestine. Here the villi are denuded by massive desquamation, whereas in the pylorus and colon fewer cells are lost. The villi are uniquely vulnerable to epithelial loss. The collapse and disappearance of the normal villus shape after cell desquamation show that its form is almost entirely due to an intact epithelium. (H.H.D.)

27104 TREATMENT OF THE LATE SKIN REACTIONS TO X RAYS. K. H. Kaercher (Universität, Heidelberg). Hautarzt, 12: 97-101(Mar. 1961).

Treatment for dermatitis and lesions in mucous membranes, particularly as a result of supervoltage radiation therapy of deep malignant tumors, is discussed. Local treatments include the use of ointments and other externally active agents, physiotherapy, and surgery. Generalized treatments may employ radioprotective agents, antihistamines, antiphlogistics, hormones, organ extracts, and vitamins. Radioreactions in skin and later scarring are diminished by agents that decrease the circulation or the oxygen supply of skin. This can be demonstrated in hibernating animals. It was also shown that application of a powder to skin before exposing it to 4500 r doses of Co^{60} radiation markedly inhibited the erythematous and epilatory response in skin. Powder was more effective than ointments in this respect, and some ointments, such as those containing triglycerides, may increase the reddening of skin. On the other hand, ointment containing protective agents, such as methionine and cysteamine, may lessen the skin reaction. Numerous other substances have been reported to reduce the skin reaction, when given parenterally, including antihistamines, vitamins A, C, K, and P, Chamazulene, and corticosteroids. Specific treatments for radiodermatitis of the bullous, necrotizing, and chronic scarring type are discussed. The improved healing tendency in patients with hyperthyroidism suggests that treatment with thyroid hormone may enhance the healing of radiation ulcers in skin. (H.H.D.)

27105 IS THE ROENTGEN DOSE NECESSARY FOR INDUCTION OF TEMPORARY EPILATION APPLIED TO HAIR FOLLICLES LESS WITH SOFT THAN WITH HARD RADIATION? Carl Georg Schirren and Liselotte Gruber (Universität, Munich). Hautarzt, 12: 536-9(Dec. 1961).

Attempts were made to confirm the conclusions of Proppe and Wagner (Strahlentherapie, 114: 39(1961)) that the biologic activity of soft radiation is greater than that of hard radiation at equivalent doses. In patients with skin diseases, 150 tests were made of the epilation induced by x rays varying in intensity from 29 to 130 kv. It was found that the magnitude of the epilating dose delivered to the hair follicles was independent of the quality of radiation. Similarly, the time for induction of epilation and time for regrowth of hair were independent of the quality. The calculated threshold dose for complete epilation, considering the hair follicle to be at a skin depth of 3 mm, varied between 312 and 350 r. Epilation occurred on an average of 16 days after irradiation and new hair appeared 2.5 to 3 months postirradiation. Hence the results indicate that soft x rays are not more effective than hard x rays at equivalent r doses. (H.H.D.)

27106 FETAL DISTURBANCES DUE TO RADIATION (NEUTRON, X RAY, AND Cs^{137}). Akira Tabuchi, Kazuo Kinutani, Shigeru Nakagawa, Masashi Hirata, Toshihiko Fujiwara, Haruma Yoshinaga, and Shigetoshi Antoku (Hiroshima Univ., Japan). Hiroshima J. Med. Sci., 11: 101-15 (1962).

Pregnant female mice were irradiated on the 4th to 15th day of gestation by 120- and 200-rad doses of 180-kvp x rays or 30- and 90-rad doses of 14.1-Mev neutrons. Other pregnant mice were injected with 2- and 4-μC/g doses of Cs^{137} to give 4-day doses of 60 and 120 rad. Developmental anomalies were seen in the fetuses of all groups except the controls and those receiving 120-rad neutron doses. These anomalies included cerebral hernia, umbilical hernia, ruptured abdomen, abnormal tail, and abnormal spine. Death and resorption of embryos occurred in nearly all of the animals receiving 200-rad x-ray and 90-rad neutron doses, compared with a control level of 25%, and the highest incidence occurred when irradiation was carried out between the 9th and 12th day of gestation. Cs^{137} was most damaging to the fetus when administered on the 4th day, but its effect did not increase with the higher dose. Sex ratio of the fetuses was not altered by x or neutron irradiation, but males showed a preponderance in the Cs^{137} group. The size and wt of fetuses were lower than normal in the x-ray and neutron groups, and postnatal deaths (up to the 21st day of life) were significantly increased with all 3 kinds of irradiation. Wt gain was lower after birth in all 3 irradiated groups compared with controls. (H.H.D.)

27107 ON THE ROLE OF DNA IN THE RADIATION DAMAGE OF THE CELL. A. M. Kuzin (Inst. of Biophysics, Moscow). Intern. J. Radiation Biol., 6: 201-9 (Mar. 1963). (In English)

Results are reported from a series of investigations of the role of desoxyribonucleic acid (DNA) in radiation injury in cells. It was concluded that radioinduced changes in DNA metabolism and state involve complex disturbances in metabolism in both the nucleus and cytoplasm of the irradiated cell. (C.H.)

27108 ON THE ROLE OF THE DISTURBANCE OF METABOLIC PROCESSES IN THE RADIATION DAMAGE OF THE CELL. A. M. Kuzin (Inst. of Biophysics, Moscow). Intern. J. Radiation Biol., 6: 211-20(Mar. 1963). (In English)

Results are reported from a series of experiments on mechanisms of metabolic reactions in cells of irradiated organisms. It was concluded that metabolites possessing anti-mitotic activity are formed in irradiated tissues and that these metabolites inhibit mitosis. (C.H.)

27109 SYNTHESIS OF PROTEIN, RNA, DNA AND INDUCED ENZYME IN BACTERIUM CADAVERIS AFTER

X-IRRADIATION. Helmut Pauly (Max-Planck-Institut fur Biophysik, Frankfurt am Main). Intern. J. Radiation Biol., 6: 221-31(Mar. 1963). (In English)

Findings are presented on the x-ray inhibition of total protein-synthesis, the induced synthesis of lysine decarboxylase, RNA- and DNA-formation and colony-formation of Bacterium cadaveris immediately after x irradiation. The rate of protein-, enzyme- and RNA-formation is an exponential function of dose with practically the same inactivation dose of 30 kr. It is concluded that the block of RNA-formation is responsible for the inhibition of protein synthesis. The colony-forming ability was found to be three times more radiosensitive. The D_{37} of the exponential survival-curve is about 10 kr. DNA-formation shows a prolongation of the time-lag after x irradiation. The oxygen-enhancement factor is roughly the same for all functions tested and lies in the neighborhood of 4. (auth)

27110 X-RADIATION AND 5-HYDROXYTRYPTAMINE-CONTENT IN THE BRAIN OF RATS AND MICE. Dj. Palaić, M. Randić, and Z. Supek (Inst. "Ruder Bošković," Zagreb). Intern. J. Radiation Biol., 6: 241-6(Mar. 1963). (In English)

Whole-body x irradiation with high doses produced an increase in the 5-hydroxytryptamine-content in the brain of normal rats and mice. This effect was obtained with smaller doses only in adrenalectomized rats. Shielding of the head or body did not suppress this phenomenon. The same held true of pre-treatment with iproniazid or reserpine. (auth)

27111 LIVER AND SPLEEN PHOSPHATASE ACTIVITY IN BONE-MARROW TRANSPLANTATION. E. M. Uyeki (General Electric Co., Richland, Wash.). Intern. J. Radiation Biol., 6: 247-55(Mar. 1963). (HW-SA-2775) (In English)

Host response to inoculation of foreign hemopoietic tissue was studied in C31 (C3H × 101) mice by assessing acid and alkaline phosphatase of spleen and liver homogenates. With intraperitoneal injections of LAF (C57L × A) spleen cells without prior x irradiation, host-spleen and liver acid phosphatase and Q values were maximal at 14 days after treatment; with prior whole-body x irradiation with 400 r, intraperitoneal injections of LAF spleen-cells gave maximal acid phosphatase values at 30 days after treatment. An intravenous injection of LAF bone-marrow suspension after 950 r whole-body irradiation doubled the acid-phosphatase activity of C31 liver tissue 14 days after treatment. In non-irradiated C31, intravenous injections of rat bone-marrow produced a 50 per cent increase in liver acid phosphatase 14 days after treatment, whereas values obtained from LAF and C31 bone-marrow injections did not differ significantly from controls. Generally, there was an increase in acid-phosphatase activity associated with an increase in Q value; but no similar association between alkaline phosphatase activity and Q value. The pattern of acid-phosphatase response after inoculation of foreign hemopoietic tissue resembled that seen after introduction of an inert macromolecular substance (PVP). (auth)

27112 PROTECTIVE EFFECT OF β-MERCAPTOETHYLAMINE AND MESENTERIC VESSEL CLAMPING ON INTESTINE-IRRADIATED RATS. Kedar N. Prasad, G. Mark Kollmorgen, Thomas H. Kent, and James W. Osborne (Univ. of Iowa, Iowa City). Intern. J. Radiation Biol., 6: 257-69(Mar. 1963). (In English)

β-mercaptoethylamine (MEA) given intraperitoneally 15 min before x irradiation or clamping of the mesenteric vessel during x-irradiation of the exteriorized ileum and jejunum in rats reduced mortality, body-weight loss in survivors, and histological damage as compared with irradiated controls. When animals which received 1800 r and MEA were compared on a mortality and histopathological basis with those exposed to 1400 r with no drug treatment, the responses were very similar. Thus, with this method for evaluation, MEA reduced the effect of the x ray exposure dose by about 20 per cent. MEA and clamping were not effective with x ray exposure doses of 2200 r and above and 3000 r and above respectively. The combination of the two treatments had a substantial additive protective effect. It resulted in 67 per cent survival at the exposure dose of 3500 r where neither treatment by itself was effective, but became completely ineffective at 4500 r and above. (auth)

27113 INDUCTION BY X RAYS OF DNA DESTRUCTION IN ESCHERICHIA FREUNDII. I. EFFECT OF THE MEDIUM COMPOSITION ON IRRADIATION AND INCUBATION. Paul M. Osterrieth (Université, Liege). Intern. J. Radiation Biol., 6: 289-96(Mar. 1963). (In French)

Destruction of desoxyribonucleic acid (DNA) occurred when Escherichia freundii was irradiated and incubated for two hours at 37°C in a medium that did not allow multiplication. The addition of various salts modified the proportion of DNA destroyed. Two types of protective effect were observed. One appeared to be linked to osmotic pressure and the other appeared to be an anti-oxygen effect. Mechanisms involved in the destruction of DNA are discussed. (C.H.)

27114 PARTIALLY DAMAGED MOLECULES AFTER IRRADIATION OF DRY INVERTASE WITH FAST ELECTRONS AND PROTONS. R. Braams (Univ. of Utrecht). Intern. J. Radiation Biol., 6: 297-300(Mar. 1963). (In English)

Experiments with commercial yeast invertase showed that, in addition to a fraction of inactivated molecules, a fraction of heat-labile molecules was formed by irradiation with electrons or protons. The results demonstrate the possibility of partial damage due to the action of ionizing radiation on large molecules. (C.H.)

27115 MEDICO-BIOLOGICAL STUDY OF THE FACTORS OF COSMIC FLIGHTS. Yu. M. Volynkin and P. P. Saksonov. Izv. Akad. Nauk SSSR, Ser. Biol., No. 3, 405-18 (May-June 1963). (In Russian)

All known physical factors that man can encounter under the conditions of a cosmic flight are conditionally divided into three groups and discussed. The first group of factors characterizes the cosmic space as a peculiar external environment of living organisms (the vacuum of the universe, a changed gas composition lacking molecular oxygen, ultraviolet, infrared, and visible portion of radiation, ionizing radiation, meteor substances. The second is related to the dynamics of a rocket flight (noise of engines, vibration, accelerations, and weightlessness). The third group characterizes the stay and life of the organism under artificial conditions of a cosmic ship (isolation, restriction of the room and motility, peculiarities of feeding, microclimate, and rhythm of life). Special attention is given to the biological action of radiation, rarefied atmosphere, and weightlessness. An attempt was also made to analyze some problems or the protection of a living being against the damaging action of individual factors of the cosmic flight. (P.C.H.)

27116 DESIGN AND CONSTRUCTION OF AN IRRADIATOR ESPECIALLY ADAPTED FOR BIOLOCIAL RE-

SEARCH. R. Ghys and J. Masefield (Université, Laval, Quebec and Atomic Energy of Canada Ltd., Ottawa). J. Belge Radiol., 46: 286-305(1963). (In French)

The study of the effects of fallout and chronic irradiation of living organisms is presently stimulating interest. It has become necessary to have facilities, individually designed, to carry out these studies. The basic design principles of facilities are discussed. The technical description of a Co^{60} γ irradiator, designed and built at moderate cost, is outlined. Detailed isodose curves measured with the unit in situ are included. A method is given for using the irradiator to simulate fallout irradiation conditions. Results of the first biological experiments carried out with this unit are summarized. (auth)

27117 DEVELOPMENT OF X-IRRADIATED AND NON-IRRADIATED MOUSE OOCYTES TRANSPLANTED TO X-IRRADIATED AND NON-IRRADIATED RECIPIENT FEMALES. Laurel E. Glass and Teh-ping Lin (Univ. of California, San Francisco). J. Cellular Comp. Physiol., 61: 53-60(Feb. 1963).

Unfertilized mouse eggs were isolated, x-irradiated in vitro or not irradiated, and then transferred to recipient females that had received various doses of whole-body x irradiation or to non-irradiated females. Response of the transferred eggs, irradiated in vitro, and of the recipient eggs, irradiated in the maternal oviduct, was analyzed to determine the contribution of maternal and oocyte damage to developmental anomalies. (C.H.)

27118 RECOVERY OF GAMMA IRRADIATED RHIZOPUS STOLONIFER SPORANGIOSPORES DURING AUTOINHIBITION OF GERMINATION. N. F. Sommer, Min Creasy, R. J. Romani, and E. C. Maxie (Univ. of California, Davis). J. Cellular Comp. Physiol., 61: 93-8 (Feb. 1963).

The effect of the absence of germination on recovery from γ irradiation was evaluated in sporangiospores of the Phycomycetous fungus, Rhizopus stolonifer. Emphasis was placed on effects of temperature and media on recovery when spores were held for varying post-irradiation periods under autoinhibitory conditions and to the effect of autoinhibition upon spore respiration and longevity. (C.H.)

27119 EFFECTS OF X-IRRADIATION OF OVARIAN OVA ON THE MORPHOLOGY OF FERTILIZED OVA AND DEVELOPMENT OF EMBRYOS. E. B. Harvey and M. C. Chang (Worcester Foundation for Experimental Biology, Shrewsbury, Mass.). J. Cellular Comp. Physiol., 61: 133-43(Apr. 1963).

Stages of meiosis in ovarian ova of hamsters were determined at various times of the estrous cycle. The right side of females was exposed to 200 r irradiation before or after the onset of estrus while the left side was shielded. The rate of meiosis was similar on the irradiated and shielded sides, but appeared to be retarded when compared with non-irradiated animals. Irradiation from 81 to 9 hr before estrus resulted in no significant increase in the incidence of abnormalities or embryonic degeneration between the irradiated and shielded sides. Irradiation 3 hr before or up to 8 hr after the onset of estrus led to the development of 21 to 26% abnormalities in cleaved ova and 79 to 91% of embryonic mortality. (C.H.)

27120 EFFECTS OF GAMMA RADIATION ON VARIOUS STAGES OF THREE FRUIT FLY SPECIES. J. W. Balock, A. K. Burditt, Jr., and L. D. Christenson (Dept. of Agriculture, Washington, D. C.). J. Econ. Entomol., 56: 42-6(Feb. 1963).

Eggs, larvae, and pupae of the oriental fruit fly (Dacus dorsalis), melon fly (D. cucurbitae), and Mediterranean fruit fly (Ceratitis capitata) were exposed to Co^{60} γ rays. Increasing dosages were required to prevent hatch as eggs became more mature except that eggs about ⅓ developed were more sensitive than younger ones. The LD_{95} for hatch of newly laid eggs was ~1300 r and for nearly mature eggs from 86000 to 125000 r. Pupation was reduced by 95% when eggs were exposed to 13000 r and 1-day-old larvae to 30000 r. More than 160000 r was required to prevent pupation of mature larvae. Dosage required to prevent 95% emergence of adults was 6500 r or less when eggs, larvae, or 1- to 3-day-old pupae were irradiated. Older pupae became more resistant to radiation, and when fully developed required more than 100000 r to prevent emergence of adults. Emerging adults were sterile after exposure as mature pupae to 10000 r. Adults from first-instar larvae exposed to 2500 r developed and laid eggs but hatch was reduced 64% in the parent stock and pupation 36% in the F_2 generation. When irradiated in water, 100% carbon dioxide, or nitrogen, the effect on eggs and larvae was 40 to 47% less than in air. The data imply that certain systems in development must be extremely sensitive to irradiation. In general, the melon fly was more resistant to radiation damage than the oriental fruit fly, but both species were more resistant than the medfly. (TCO)

27121 ENHANCEMENT OF ANTIBODY FORMATION BY WHOLE-BODY X RADIATION. Frank J. Dixon and Patricia J. McConahey (Scripps Clinic and Research Foundation, La Jolla, Calif.). J. Expti. Med., 117: 833-48 (May 1, 1963).

Studies were undertaken to elucidate mechanisms by which large doses of whole-body x radiation might enhance antibody formation. The effects of x rays on responses to a variety of antigens were studied in attempts to correlate the time of effectiveness of x rays with events transpiring in the immune response. It was found that not all antibody responses are equally enhanced by x radiation and that the time after antigen administration at which radiation has its greatest enhancing effect varies with the kind and the physical state of the antigen. In general, the most effective time of administration of x rays appears to be related to the beginning of cellular proliferation, detectable antibody formation, and the fixation of circulating antigens in the tissues. It was shown that whole-body x radiation in heavy, cytotoxic doses can increase and even accelerate the antibody response, particularly in primary responses to bovine γ-globulin (BGG) (native and heat-aggregated) and hemocyanin, and to bovine serum albumin (BSA) when given after passively administered anti-BSA. The radiation must follow the antigenic stimulus, and the optimum time varies with the kind and form of the antigen. The more rapid the antibody response, the earlier x radiation may be given to enhance the response. With native BGG the interval between stimulus and max serum antibody was 10 to 11 days and x radiation gave max enhancement when administered 2½ days after antigen. With heat-aggregated BGG the interval between stimulation and max antibody was only 7 to 8 days and x radiation gave max enhancement when administered as soon as 2 hr after antigen, although comparable enhancement also could be elicited with x rays 1 and 2 days after aggregated BGG. The long period during which x ray could be administered and still enhance the response to aggregated BGG may be related to the lack of uniformity in the size and therefore the behavior of the aggregates. Some were very large and were promptly removed from the circulation and others were small and persisted in the circula-

tion. The proposed explanation of the radiation-induced enhancement of antibody formation is as follows: (a) x radiation given early in the immune response, probably before most of the cellular multiplication has occurred, destroys the majority of lymphoid cells, leaving behind depleted lymphoid tissues. (b) of the remaining lymphoid cells, those that are responding would be expected to multiply much more rapidly than those that are unaffected by the antigen. (c) The cellular proliferative response after antigenic stimulation and x radiation together is more rapid and extensive than after either alone. During this exaggerated proliferation the rapidly dividing antigen-stimulated cells outgrow their nonstimulated counterparts, resulting in the observed increased antibody formation and large numbers of antibody-containing cells. A thymectomy experiment showed that the thymus does not play a major role in the immediate postradiation recovery of the antigen-stimulated lymphoid tissues in contrast to its reported role in long-term postirradiation recovery. The enhancement of antibody formation by x rays is a convenient laboratory tool for obtaining hyperimmunized animals in a short period of time with little antigenic exposure. Also, these results contraindicate clinical attempts to inhibit by x radiation the immune response of patients to antigens recently administered, such as is used to delay or obliterate the homograft response of patients subjected to homografts. (H.H.D.)

27122 AN ASSAY OF GRAFT-HOST INTERACTIONS ACROSS STRONG AND WEAK HISTOCOMPATIBILITY BARRIERS IN MICE. Joshua Miller, James C. Pierce, Carlos Martinez, and Robert A. Good (Univ. of Minnesota, Minneapolis). J. Exptl. Med., 117: 863-78(May 1, 1963).

Studies were undertaken on the assumption that graft-host interactions when both donor and recipient are capable of immune responses may be quite unlike the unidirectional graft-vs-host reaction. A new criterion of graft-host interactions is presented, based on the early finding of mononuclear cell infiltrates of donor origin in the livers of recipient mice after administration of homologous lymphoreticular cells. In the evaluation of donor cell reactivity these infiltrates are consistent in appearance as compared with spleen enlargement, a more variable and complex response. This model is sensitive enough to detect such graft-host interactions between strains with a common H-2 histocompatibility locus, and can detect differences in the degree of reactivity of strains to each other when injected reciprocally. When cell products or cells unable to proliferate were injected, i.e., sonically disrupted or lethally x irradiated cells, no liver infiltrates were seen. In addition, an infiltrate incidence of 17% was obtained both when F_1(A × C57B1/1) hybrid spleen cells were injected into A recipients, or when spleen cells from thymectomized A strain donors were injected into C57B1/1 (B_1) recipients. By contrast, A cells injected into thymectomized or x-irradiated B_1 recipients produced liver infiltrates in all the animals. Thus, it appears that these infiltrates, present after the injection of immunologically responsive donor cells into unresponsive hosts, were of donor origin. Spleen cells from lethally x-irradiated A strain animals were injected into B_1 recipients, and AB_1 F_1 hybrid cells into A recipients. In both cases only a slightly greater spleen enlargement was obtained. When cells from thymectomized A strain donors were injected into B_1 recipients, a splenomegaly significantly greater than that of the former groups was observed. There was also a significant splenomegaly when A spleen cells were injected into neonatally thymectomized B_1 animals. In the x-irradiated B_1 recipients of A spleen cells, spleen wt decreased, but was significantly greater than those found in lethally x-irradiated but noninjected controls. Thus, the quality or quantity of injected antigen may have played a role in inducing spleen enlargement in the recipients. In addition, splenomegaly may have been due to specific immune responses on the part of the donor cells against the recipient. Spleen enlargement seems to stem from a more complex combination of causes, while the infiltrative lesions of the liver appear to be only proliferating donor cells. Graft-host interactions were also demonstrated in the DBA/2 and Balb/C strains isogenic at the H-2 histocompatibility locus. The lag observed in the appearance of liver infiltrates when DBA/2 spleen cells were injected into the Balb/C host, as compared with the reciprocal arrangement, parallels the degree of facility of reciprocal tolerance induction in adult animals of these strains. Tolerance to Balb/C skin grafts is achieved in adult DBA/2 animals by a single intravenous injection of only 100 million Balb/C adult spleen cells. However, multiple intravenous injections of DBA/2 cells, or a single injection of DBA/2 cells following sublethal x irradiation, were needed to achieve tolerance in Balb/C recipients. (H.H.D.)

27123 CONTINUOUS COBALT-60 IRRADIATION AND IMMUNITY TO INFLUENZA VIRUS. J. J. Quilligan, Jr., R. D. Boche, E. J. Carruthers, S. L. Axtell, and J. C. Trivedi (Loma Linda Univ., Los Angeles). J. Immunol., 90: 506-11(Apr. 1963).

Mice were exposed to Co^{60} γ rays at a dose rate of 9, 16, 33, or 106 r/day for total doses up to 2547 r. After 15 days exposure, they were infected with PR8 strain type A influenza virus and hemagglutination titers in their serum were followed. It was shown that continuous irradiation, both prior to and during the course of infection with influenza virus, results in a continued growth of virus particles in lungs of infected animals and results in much higher titers for longer periods of time than in nonirradiated animals. This ability for unsuppressed growth of virus in lungs of irradiated animals appears to be related to radiation dose. The phenomenon of prolongation of the interval for virus production was shown to be associated with an impaired ability to produce antibody in animals receiving the greatest γ-radiation exposures. In the dosages utilized, irradiation interferes with primary influenza virus antibody response, but does not interfere with secondary antibody response. Differences observed between primary and secondary antibody responses could be related to effect of antigens on lymphocyte radiosensitivity. The possibility, however, that earlier stimulus had produced a larger number of antibody-producing cells and that more cells require a greater amount of irradiation must also be considered. (H.H.D.)

27124 EFFECT OF WHOLE-BODY X IRRADIATION ON INDUCTION OF ALLERGIC ENCEPHALOMYELITIS IN RATS. Philip Y. Paterson and Norman E. Beisaw (New York Univ., New York). J. Immunol., 90: 532-9(Apr. 1963).

The results indicate that 400-r whole-body x irradiation given to rats prior to sensitization with spinal cord and adjuvant suppresses allergic encephalomyelitis (AE). This suppression is dose-dependent and may be observed in two strains of rats sensitized by either of two routes. Conversely, whole-body x irradiation given after sensitization does not suppress AE. The data indicate that leukopenia does not account for suppression of AE in x-irradiated animals. Suppression of AE by x irradiation is most likely due to interference with immune responses to spinal cord plus adjuvant. Direct support for this view is provided by the fact that suppression of AE is paralleled by reduced complement-fixing anti-brain antibody formation. Doses

of x irradiation used in this study appeared to exert no appreciable influence on development of delayed-type reactivity, as judged by tuberculin skin tests. The skin reactions to tuberculin observed in rats represented delayed-type immune responses against tuberculin antigens rather than heightened nonspecific cutaneous reactivity, e.g., brought about by prior injection of adjuvant. It is noteworthy that unequivocal positive tuberculin reactions could be elicited in x-irradiated rats in which AE was clearly suppressed. Results of the present study in the rat are consistent with the thesis that circulating anti-brain antibody may play a role in production of AE. (H.H.D.)

27125 EXPERIMENTALLY INDUCED ALTERATIONS OF THE BACTERICIDAL PROPERTY OF RABBIT SERUM FOR BACILLUS SUBTILIS. I. EFFECTS OF TOTAL BODY X-RAY IRRADIATION, INTRAVENOUS ADMINISTRATION OF IMMUNE PLATELET SERUM, THOROTRAST AND INTRAPERITONEAL INJECTION OF ENDOTOXIN. Gene G. Hunder and Ralph F. Jacox (Univ. of Rochester, N. Y.). J. Immunol., 90: 540-7(Apr. 1963).

Rabbit blood platelets contain two protein fractions which, with bicarbonate ions, constitute a heat-stable bactericidal system for B. subtilis. These two components are released from rabbit and rat platelets during blood coagulation and after mechanical disruption of washed platelet suspensions. These are designated components 1 and 2. Total-body x irradiation of 700 r causes a striking reduction of platelets and of components 1 and 2. As little as 100 r of x irradiation produces a decrease of component 1 without causing a decrease of platelets. Specific antiserum for rabbit platelets causes a rapid decrease in platelets and in components 1 and 2, when injected intravenously into rabbits. In vitro studies reveal that normal rabbit serum loses its bactericidal property when antiplatelet serum is added. Highly bactericidal rat serum is not inhibited by antirabbit platelet antibody. Intravenous injection of Thorotrast into rabbits causes a precipitous decrease in platelets and of components 1 and 2 without producing any decrease in leukocytes or hematocrit. (H.H.D.)

27126 THE PREVENTION OF HEPATIC METASTASIS BY THE USE OF A COLLOIDAL SUSPENSION OF RADIOACTIVE CHROMIC PHOSPHATE ($CrP^{32}O_4$). Arthur S. McFee, Norman B. Ackerman, and Merle K. Loken (Univ. of Minnesota, Minneapolis). J. Nucl. Med., 4: 234-8(May 1963).

A method for the prevention of hepatic metastatic disease via the portal vein by use of intraportal colloidal chromic phosphate is presented. Reduction in the number of metastases over control animals by 50 per cent was observed. (auth)

27127 SINGLE DOSE X-RAY RADIATION TO THE LUNG AND POSTERIOR MEDIASTINUM. IV. RESULTS IN DOGS RECEIVING 1500 r TO BRONCHIAL STUMPS AND ESOPHAGEAL ANASTOMOSES. John J. Fomon, Frank T. Kurzweg, and Harold David (Univ. of Miami, Fla.). J. Thorac. Cardiovasc. Surg., 45: 302-6(Mar. 1963).

Through a thoracotomy with surrounding tissue protected, single-dose radiation was administered in 10 dogs directly to freshly sutured bronchial stumps and esophageal anastomosis in 1500-r doses. Two dogs died as a direct result of the radiation. Three animals died, probably of unrelated causes, between 197 and 333 days postirradiation. The remaining 5 dogs were sacrificed between 699 and 722 days postirradiation. In no instance did the radiation prevent healing of the suture lines. Of the 2 dogs that died of the effects of radiation, one showed necrosis of the trachea with hemorrhage and the other a tracheo-atrial fistula. Of the 3 dogs that died as the result of infection, one had empyema with spontaneous drainage but parenchymal necrosis was not present and the bronchial stump and esophageal anastomosis were intact. The second developed an abscess in the axilla opposite the side operated upon and the remaining animal had bilateral pneumonitis. It is doubtful that radiation was a contributory cause of death. Thus only 2 of the 8 dogs died as a direct result of the radiation. The variable response of the animals in the series is difficult to explain. However, the technique and dose did not seriously impair healing of the bronchial stump or esophageal anastomosis. (TCO)

27128 STUDIES ON X AGENT. XIII. EFFECT OF X AGENT ON ERYTHROCYTE SEDIMENTATION RATE. Hideo Moriyama (Shonan Hygiene Inst., Kamakura, Japan). Japan. J. Microbiol., 5: 223-35(Apr. 1961).

The effect of X agent, a postulated form of high-energy radiation possibly related to cosmic radiation, on erythrocyte sedimentation rate (ESR) of cells from citrated human blood resuspended in saline was investigated. It is postulated that X agent consists of radiation components of differing intensity and gives rise to secondary emissions when absorbed by certain materials. Attempts were made to demonstrate the effects of X agent on ESR by arranging the sedimentation tubes in various positions and at different sites. Since varying ESR values were noted in different tubes, not explainable by other variables, it was concluded that variations in the field intensity of X agent were responsible for the differences. The rate was increased when the tubes, covered with black paper, were placed near a window with southern exposure, although artificial forms of illumination or heat showed no effect. A spatial effect was obtained by placing rows of tubes in different directions. It was concluded that X agent has a spatial pattern, with variations over very small distances (20 to 30 cm), that can be detected by its effects on biological materials. The pattern is said to change rapidly so that no two identical patterns are ever obtainable even at the same locus. (H.H.D.)

27129 STUDIES ON X AGENT. XIV. EFFECT OF LEAD SHIELD ON ERYTHROCYTE SEDIMENTATION RATE. Hideo Moriyama (Shonan Hygiene Inst., Kamakura, Japan). Japan. J. Microbiol., 5: 261-75(July 1961).

A previously described effect of X agent on erythrocyte sedimentation rate (ESR) was further investigated. Human red cells suspended in saline were placed in a series of tubes, some of which were surrounded by Pb blocks, to act as a barrier to X agent. Intratube variations in ESR were less when Pb shielding (5 cm) was employed, from which it was concluded that Pb absorbed a soft radiation component responsible for raising ESR. Southern exposure of the tubes had the greatest effect in increasing ESR. When the tubes were arranged in front of a Pb pile, it was noted that ESR increased in tubes on the northern side of the pile, from which it was interpreted that absorption of some components of X agent by the pile resulted in secondary emissions that affected ESR. Daily variations in intensity of the effects on ESR were noted, on some days the intratube variation in ESR being greater than on others. Also the directional pattern changed, northern exposure having a stronger effect than usually. (H.H.D.)

27130 X-RAY-INDUCED CARCINOMA SIMULATING NOMA. T. Inoue, Y. Shirakawa, and G. Choba. Jibi Inkoka, 34: 419-20(May 1962).

The case history is reported of a 16-yr-old girl who

developed a carcinoma of the skin 4 yr after x-ray treatment of a hemangioma at the same site. (H.H.D.)

27131 ON THE MODE OF ACTION OF IONIZING RADIATIONS ON BIOLOGICAL SYSTEMS. T. Tobe. Kitakanto Igaku, 12: 85-105(1962).

27132 EFFECT OF γ-RAY IRRADIATION ON RED SEAWEEDS. Kakuji Katsuura, Shozaburo Suzuki, and Toshimasa Okano (Shizouka Univ., Shizuokaken, Japan). Kogyo Kagaku Zasshi, 65: 1076-8(July 1962).

The influence of γ irradiation on chemical composition and physical properties, especially on jelly-forming ability, of red seaweeds (Rhodophyceae) was studied. Kirinsai (Eucheuma spinosum) and Ogonori (Gracilaria confervoides) were used as the samples of red seaweeds, and the raw seaweeds and the extracted mucilage from Kirinsai were irradiated by Co^{60} γ rays at doses ranging from 10^4 to 10^7 r. After irradiation the relations between irradiation dosage and jelly strength, viscosity, and sulfate and carboxyl group content of the mucilage were examined. It was observed that irradiation did not increase jelly strength owing to the de-esterification of sulfate group, but it led to degradation of the main chain. From the results of fractionation experiments and the decrease of carboxyl group by irradiation, it was concluded that Kirinsai consists of the various kinds of polysaccharide and is not a polymer of a single component such as is true of Ogonori mucilage. (H.H.D.)

27133 PROLIFERATION OF ELASTIC FIBERS AFTER X IRRADIATION. S. Jellinek (Universität, Vienna). Lancet, 2: 1192-3(Dec. 8, 1962).

Immediate and delayed effects on the elastic fibers from irradiation in vivo were investigated by x irradiation of the rabbit ear with 300 or 3000 r. Fissuring of the vessel walls was found in the ears examined immediately after irradiation. After 24 hr there was swelling of the epidermal cells, sebaceous glands, and hair follicles, with edema of the subcutaneous tissues. Swelling of the vessel walls with separation of the smooth-muscle fibers was also noted. After 1 week, changes in the vessel walls were even more distinct. No subcutaneous elastic network could be discerned, although there was much fibrous debris. The changes were less evident at the 4th week than the 1st, the vessels showed healing, and newly formed elastic fibrils were evident. In all sections stained for elastic fibers there was a delicate network of apparently proliferating fibrils. However, all the fibrous debris visible after 7 days had disappeared and the fibrils seemed to be regenerating de novo. The results show that elastic fibers are particularly susceptible to damage by irradiation, and are broken and fissured immediately after irradiation. (TCO)

27134 RADIOBIOLOGICAL REACTIONS AT THE SUBCELLULAR LEVEL. Z. Zseboek (Medical Univ., Budapest). Laval Med., 34: 9-11(Jan. 1963). (In English)

From Symposium on Radiosensitivity, Laval Univ., Quebec, Sept. 1962.

The alteration of cell proteins by the products of radiochemical reactions is discussed. (H.H.D.)

27135 RADIOSENSITIVITY AT THE SUBCELLULAR LEVEL. Anna Goldfeder (New York Univ., New York). Laval Med., 34: 12-43(Jan. 1963). (In English)

From Symposium on Radiosensitivity, Laval Univ., Quebec, Sept. 1962.

Studies were carried out at a subcellular level on 2 types of mouse mammary tumors, an epithelial slow-growing type, designated H, and a fast-growing spindle cell tumor, designated G. Both tumors are of the same genetic origin, having arisen from the mammary gland tissue of the inbred DBA/212 strain of mice. The tissues were irradiated in situ with various doses of x rays, up to 10000 r. A study of the distribution of catalase activity within the mitochondrial, microsomal, and cell sap fractions of both types of tumors showed that the highest activity of the enzyme resides in the mitochondrial fraction of the epithelial tumor, and in the cell sap fraction of the spindle cell tumor. A shift in catalase activity from mitochondrial to cell sap fraction occurred following irradiation of the tumors in situ. This is explained by a change in permeability or fragility of the mitochondrial membranous system. Electron microscopic studies of the tumors following irradiation revealed profound changes in the mitochondrial structures and ruptures in the limiting plasma membranes. Evidence is presented that the quantity and quality of the membranous system including mitochondria play a significant role in cellular radiosensitivity. It is conceivable that the variation in radiosensitivity between different cell types is due to the difference in their cytoplasmic composition, specifically in the quality of the membranous system. It is suggested that interphase or acute cell death is caused by radiation damage to the plasma membrane. It is proposed that: the quality and quantity of the cytoplasmic constituents are determining factors in cellular radiosensitivity, and radiation damage to the membranous system (including mitochondria) such as change in permeability, dilatation of vesicles, and rupture of the limiting plasma membrane are the cause of interphase cell death. The cells that are rich in submicroscopic vesicles and poor in mitochondria seem to be the most radiosensitive. (TCO)

27136 RADIATION. THE CELLULAR APPROACH. G. M. Clark and D. G. Baker (Univ. of Toronto). Laval Med., 34: 44-7(Jan. 1963). (In English)

From Symposium on Radiosensitivity, Laval Univ., Quebec, Sept. 1962.

Experiments were conducted on Escherichia coli to investigate the process of filament formation (elongation without cell division) which is known to occur following x irradiation. A study was made of the effects of x radiation administered at various dose rates for varying total dosages, as well as the effect of temperature on this process. Following x irradiation, bacterial cells showed a cessation of cell division without complete inhibition of growth. At the highest dose rates used (3080 rad/min), for a total dose of 30 krad, there was less growth while at lower dose rates (290 rad/min for a dose of 30 krad) the inhibition of cell division lasted longer. Filament formation was also evidenced when nonirradiated cells were incubated at 15°C. DNA synthesis was inhibited by x irradiation and was resumed sooner when higher dose rates were used. This was of particular interest in the light of previous evidence that cells receiving the higher dose rate of irradiation resumed cell division sooner. It is postulated that following x irradiation, cell membrane permeability was altered resulting in a change in the internal ionic milieu. Within certain limits of dose, sodium increased in the cell to a point where although growth still continued, synthesis of DNA was inhibited and cell division ceased. Chromatographic analysis of the media upon which x-irradiated cells of the protozoan Tetrahymena pyriformis were growing, indicated that transamination involving the production of alanine and aspartic acid was impaired. Thus an investigation of the effects of x rays administered at varying total dosages and varying dose rates on transamination was undertaken. Following

x irradiation the cellular transaminase activity decreased. For doses in the mid-lethal range, maximum enzyme inhibition was observed at intermediate dose rates (1400 and 1800 rad/min) and minimal loss of activity at the highest and lowest dose rates (3000 and 600 rad/min). Complete recovery was not observed by the seventh transfer, with 15° and 25° postirradiation treatment. At 35°, however, there was a recovery to values equal to, or occasionally exceeding the control. These investigations indicated that dose, dose rate, and postirradiation incubation temperatures were important factors in modifying the response of cells to radiation as manifested by filament formation and changes in transaminase activity. (H.H.D.)

27137 INFLUENCE OF PREIRRADIATION WITH WEAK DOSES ON THE EFFECTS OF A STRONG DOSE OF RADIATION. STUDY OF THE HISTOLOGIC REACTIONS OF SPLEEN AND TESTIS IN THE RAT. L. Diethelm and W. Lorenz (Universität, Mainz). Laval Med., 34: 48-52(Jan. 1963). (In French)

From Symposium on Radiosensitivity, Laval Univ., Quebec, Sept. 1962.

Rats were subjected to 600-r whole-body x irradiation given in a single dose. Some of the animals had been preexposed to low doses (3 r/day for 10 days). The mortality rate was not significantly different between the 2 groups; 50% of the animals in both groups died by the 9th postirradiation day. Histologic study of the spleen 2 days after the 600-r dose revealed that in about half of the pre-exposed rats the marked involution of lymphatic nodules seen in irradiated controls was absent. Thus, several rats showed abundant lymphocytes and well-developed reticular tissue, whereas in the controls the number of lymphocytes and reticulum cells was markedly diminished. Examination of the spleens 8 days postirradiation also showed in some instances that preirradiation accelerated the recovery of lymphatic tissue; however, such was not the case in all of the animals. There were marked individual differences in the recovery of the spleen in both groups. Histologic reactions in testis showed a parallel to those in spleen, namely, that in some, but not all, preirradiation conferred a degree of radioresistance on germinal cells. Marked individual differences in radiosensitivity and response to preirradiation were noted. (TCO)

27138 RADIOSENSITIVITY OF RAPIDLY DIVIDING CELLS. S. Lesher (Argonne National Lab., Ill.). Laval Med., 34: 53-6(Jan. 1963). (In English)

From Symposium on Radiosensitivity, Laval Univ., Quebec, Sept. 1962.

The entire cell generation cycle (GC) is divided into 4 sequential stages: mitosis (M), a postmitotic nonsynthesis period (G_1), DNA synthesis period (S), and a premitotic nonsynthesis period (G_2). Techniques were designed to study each phase of the GC. Duration of GC was estimated by determining the percent labeled mitotic figures at closely spaced time intervals after injection of tritiated thymidine. All stages of the GC can be modified by irradiation. Radiosensitivity depends on cell type, dose, dose rate, exposure pattern, and whether the cells are exposed in vivo or in vitro. After acute single or simple fractionated exposures, the changes produced in all rapidly dividing cells are essentially the same; a majority of cells in division complete M, those about to enter division may be stopped and temporarily retained in G_2, cells in the process of synthesizing DNA and making new chromosomes may be partially or completely inhibited, and the flow of cells from G_1 to S may be retarded. Blockage of cells in G_2 is one of the immediate effects of irradiation and can be produced by relatively low doses. Even after very high doses most of the cells in G_1 and S at time of irradiation pass through the S period and synthesize DNA. The inhibition of DNA synthesis appears to be an indirect effect, resulting from changes in the cell population, rather than a specific lesion in the biosynthetic mechanism. The following generalizations are made concerning the effects of acute radiation on rapidly dividing cells: all phases of the GC may be slowed; G_2 appears to be the most radiosensitive phase; very high radiation doses are needed to inhibit DNA synthesis completely, although the synthetic rate may be reduced by lower doses; chromosome damage may occur in any phase, but is greatest in G_2 or S; and most radiation damaged cells will be eliminated after a few divisions. When mice were exposed to 12 r/day for 200 days the duration of the intestinal crypt cell generation cycle and the variability of the measurements were less than in the unirradiated animals of the same age. In mice irradiated for 500 days at 12 r/day the duration of the GC of the crypt cells was greater than that of nonirradiated animals of the same age. Both duration and degree of variability resembled that in very old mice. These data suggest that with increasing time of exposure the recovery mechanism becomes less able to compensate for radiation damage, and at 500 days is approaching a critical time beyond which the animal cannot survive. A one-day exposure of mice to 220 r/day produced the same pattern of effect as a single acute exposure of 50 r or more delivered at a faster rate. If exposure to either 12 r or 220 r/day continued, the duration of the GC was reduced to compensate for radiation damage. With continued exposure the compensatory effect is lost, and production of cells becomes insufficient to maintain the number necessary for survival. (H.H.D.)

27139 CONSIDERATIONS IN TISSUE RADIOSENSITIVITY. A. Zuppinger (Hopital de l'Ile, Bern). Laval Med., 34: 57-62(Jan. 1963). (In French)

From Symposium on Radiosensitivity, Laval Univ., Quebec, Sept. 1962.

The response of rat bone and lens to x irradiation was investigated. The rats were given Ca^{45} immediately after local irradiation of one leg with 2000 r. One-half day after irradiation the uptake of Ca^{45} by irradiated femur was appreciably less than that of unirradiated bone, and 1 day after irradiation the uptake was diminished by more than 50%. The uptake continued to fall during the first week and remained low (50% below normal) 2 months after irradiation. In the nonirradiated bone only a transient depression of Ca uptake was noted, presumably as a result of toxic products liberated from irradiated tissue. The decline in Ca incorporation in irradiated bone was proportional to the dose between 0 and 3000 r. Inhibition of Ca uptake was more pronounced with 250-kv x ray than with 30-Mev electron irradiation. Injury to the lens was more severe with x-ray than high-speed electron irradiation. Osteoclasts in rat femur and tibia proved to be more sensitive to irradiation than osteoblasts and were markedly reduced in numbers for 2 months by 1000 to 2000 r of x rays. On the other hand, osteoblasts were depleted only at the 2000 r dose and their fall in numbers was slower than in the case of osteoclasts. Results on rat bone and lens indicate RBE values of 0.9–10 for 250-kv x rays and 0.6–0.7 for 30-Mev electrons. The lower RBE for electrons is explained in terms of a lower probability of their absorption in a given tissue target volume. (H.H.D.)

27140 INVESTIGATION OF THE MOLECULAR NATURE OF CELLULAR RADIOSENSITIVITY. J. L. Van

Lancker (Univ. of Wisconsin, Madison). Laval Med., 34: 63-8(Jan. 1963). (In French)

From Symposium on Radiosensitivity, Laval Univ., Quebec, Sept. 1962.

The locus of cellular radiosensitivity was studied in rats and mice by measuring the uptake of radioactive precursors in nucleic acids at various intervals after irradiation of partially hepatectomized animals. During hepatic regeneration, biochemical events that lead to cell division follow one another in a well-defined sequence. Accordingly, active synthesis of nuclear RNA is quickly followed by cytoplasmic RNA synthesis, which, in turn, is followed by formation of new proteins, among which are thymo 5-phosphate kinase and polymerase. Following incorporation of precursors either in vivo in various subcellular preparations of regenerating liver of irradiated animals or, in vitro in various subcellular preparations of regenerating liver obtained from irradiated animals, it was possible to demonstrate that x irradiation inhibits DNA synthesis in regenerating liver. The results suggest that the radiosensitive target is present during interphase and that the latent cellular damage becomes apparent only when cell divisions are induced in the liver. (TCO)

27141 THE INFLUENCE OF NUCLEAR FACTORS ON RADIOSENSITIVITY. Roger Mathieu (Hôpital Notre-Dame, Montreal). Laval Med., 34: 85-9(Jan. 1963). (In French)

From Symposium on Radiosensitivity, Laval Univ., Quebec, Sept. 1962.

The DNA content of liver cells was investigated by microspectrophotometry of isolated nuclei from the liver of rats irradiated and subjected to partial (66%) hepatectomy. Changes in the relative numbers of nuclei containing 2, 4, 8, and 16 + 32 times the normal haploid complement of DNA were recorded. The rats were irradiated with 950-rad doses of x rays in the abdominal region or were injected with colloidal Au^{198}, which gave an estimated liver dose of 6500 rad. Nuclei that contained twice (2N) the haploid DNA content showed a marked increase 1 day after hepatectomy of controls, but the increases were less marked and delayed in irradiated rats. In contrast to the slow gradual rise of 4N nuclei in controls, in irradiated rats the number of the nuclei declined to low levels, which became minimal on the 12th day postirradiation. In both the 8N and 16N + 32N series the number of nuclei rose sharply to much higher levels than in nonirradiated controls. Similar results were obtained with both types of irradiation. The results demonstrate the tendency toward polyploidy in irradiated liver cells. (H.H.D.)

27142 THE INFLUENCE OF IMMUNE REACTIONS ON THE RADIOSENSITIVITY OF TUMORS. E. Benassi (Universitâ, Turin). Laval Med., 34: 90-4(Jan. 1963). (In French)

From Symposium on Radiosensitivity, Laval Univ., Quebec, Sept. 1962.

Basic concepts of tumor immunology are reviewed and results are reported on the effect of x irradiation on the response of KB tumor cells exposed to cytotoxic serum in vitro. Irradiation of the cells with 110 r or treatment with cytotoxic serum caused in each case ~50% reduction in the number of viable cells. However, both treatments acting on the cells had a marked destructive effect. Only 10% of the cells remained viable when serum treatment followed irradiation and <5% survived when irradiation followed immersion in cytotoxic serum. The accelerating effect of irradiation on cytotoxicity was illustrated by phase contrast photomicrographs. It is suggested that radiation either sensitizes the cells to host immunologic defense mechanisms or in some way liberates antigenic material that stimulates the immune defense reactions. Tumor immunity was founded on the assumption of the existence of antigens in the tumor cells, capable of provoking an immunologic reaction in the bearer. The isolation and biochemical definition of the factors of the specific tumor antigen present great difficulties because the tumors originate in pre-existing tissues. However, through various techniques it was shown that differences exist in antigenicity between tumor and normal cells. It is postulated that some organic components of the neoplastic cells differ in their molecular configuration from the components of normal cells so as to provoke autoimmunization in the bearer. (H.H.D.)

27143 RADIORESISTANCE. D. G. Baker (Univ. of Toronto). Laval Med., 34: 95-103(Jan. 1963). (In English)

From Symposium on Radiosensitivity, Laval Univ., Quebec, Sept. 1962.

Young male rats were exposed to whole-body irradiation from a Co^{60} source at various dose rates up to 100 r per 23 hours day. At the highest dose rate (100 r/day), there was progressive injury with lethal termination after about 2 to 3 weeks. At doses below 80 r, the same initial reaction was noted but became less severe as time passed until, by about 10 days from the start of exposure, recovery appeared to compensate for injury. Both nitrogen and phosphorus balance in these rats were closely related to the body-weight changes and food intake and showed the same recovery pattern. None of these animals died during, or within 30 days from the end of irradiation. Mice were exposed to a fixed dose of x rays (630 rad) but delivered at dose rates of from 1 to 180 rad/min. A probit plot of per cent mortality against the dose rate on a log scale shows that the data fit 2 straight lines. The slope of the line between 10 and 100 rad/min is steeper than that between 0 and 10 rad/min. The lower dose rates possibly allow for the recovery of some critical system which at higher dose rates becomes limiting. Experiments to determine whether this dose rate effect can be explained in terms of the classical recovery factor, as proposed by Blair et al., were conducted. Mice received a fixed dose of 200 r whole-body x irradiation at a constant dose rate of 40 r/min. Immediately following this, 3 groups received an additional exposure to 430 r at either 40, 20, or 10 r/min. Two days following the initial dose, 3 other groups were also exposed to 430 r at dose rates of 40, 20, or 10 r/min. Six remaining groups were similarly exposed at 8 and 16 days intervals. This experimental regimen was then repeated except that the initial dose of 200 r was given at either 10, 20, or 40 r/min, and the challenging dose of 430 r given at a constant dose rate of 40 r/min. The 30-day mortality was observed. When the dose rate of the final dose was varied, it was apparent that there was no dose rate effect. When the dose rate of the initial exposure was varied, however, a highly significant dose rate effect was observed. The data indicated that the recovery function contained a factor which was independent of the interval between exposures (up to 16 days) but was determined by the rate of injury, the higher rate producing the more serious injury. Attempts were made to determine what effect exposures given at dose rates known to prevail in the early fallout area of an atomic explosion are likely to have on the acute radiation response. Actual observations indicate that under these conditions, the dose rate from the γ component of fallout follows the empirical relation $R_t = R_{1t}t^{-1.2}$ where R_t is the rate at time t. To simulate this regimen of exposure a Co^{60} device was arranged which would vary the dose rate continuously so as

to obey the required power function of time. Thus mice were given various doses of radiation as simulated fallout, lasting 96 hr; at a constant dose rate over the same 96 hr; and in a few min at a dose rate of 65 r/min. Irradiation delivered either as in a simulated fallout or at a constant dose rate over 96 hr doubled the $LD_{50/30}$ compared to an acutely delivered dose. Also, under these experimental conditions the fallout exposure was less effective than the slow regimen as far as 30-day mortality was considered. The results raise the possibility of the elaboration of some sort of transient, nonspecific protective substance against the toxic products produced by cells injured or killed as a result of the radiation. In an effort to account for the varying effectiveness of fixed doses of radiation given at different dose rates it is proposed that a particular metabolic process may be overwhelmed, hence, it becomes limiting. This hypothesis was tested by irradiating populations of the ciliated protozoan Tetrahymena periformis at different doses analyzed for various metabolic intermediates. Metabolic studies and dose response relations were examined using the cells surviving acute and chronic exposures. The results indicated that survivors from mid-lethal x irradiation elaborated into the media metabolic intermediates not present in the control cells or media. Thus in these irradiated cell populations, radioresistance may involve the ability of the cells to adopt alternate metabolic pathways. (H.H.D.)

27144 TIME AND INTENSITY FACTORS. Boris Rajewski (Max-Planck-Institut für Biophysik, Frankfurt am Main). Laval Med., 34: 104-5(Jan. 1963). (In English)

From Symposium on Radiosensitivity, Laval Univ., Quebec. Sept. 1962.

Participation of time-intensity (T-I) factors in the sequence of biologic reactions following irradiation of cells is discussed. Three different steps involving the effectiveness of T-I factor can be distinguished: its bearing on the primary physical processes of the radiation effect (multi-hit); its bearing on the biochemical processes of the radiation effect; and its bearing on the physiological and cytological processes of the radiation effect. From the biological point of view, all the processes occurring during and after irradiation may also be divided into 3 groups: cell and tissue destructive processes; regulatory processes (hormonal and enzymic processes); and cell and tissue regenerative processes (for example, bone and connective tissue formation, cell and tissue repair). This is illustrated by the effects of whole-body irradiation. Some examples of experimental results pertaining to this point are discussed. From these, it is clear that: there are relatively sensitive or critical organs in the organism; the time-course of the speed of individual reactions is of decisive importance; and the counter-reactions can bring about a constant irradiation effect at a certain dose range. (H.H.D.)

27145 INFLUENCE OF PROTRACTION AND FRACTIONATION OF DOSES IN RADIOTHERAPY. J. Dutreix (Institut G. Roussy, Villejuif, France). Laval Med., 34: 106-23(Jan. 1963). (In French)

From Symposium on Radiosensitivity, Laval Univ., Quebec, Sept. 1962.

The effects on tumors of small repeated doses given at intervals, in contrast to single large doses of radiotherapy, are discussed. In general, the effect produced diminishes with the increased duration of the irradiation period. The dose (D_t) necessary to produce an effect in a given time (t) can be expressed by the dose time relation: $D_t = D_1 \cdot t^p$, with D_1 = dose necessary to obtain a similar effect by a single acute irradiation dose and p = a coefficient of the order of 0.2 to 0.3. This suggests the occurrence of a restoration which was initially attributed to the production by radiation of a toxin, which disappears spontaneously. However, the shape of the survival curves suggests that cells behave like multiple-target structures and that their ability for indefinite multiplication is suppressed only if all the targets are hit within a sufficiently short time, of the order of a few hours. The selectivity of action on tumor tissue as compared to normal tissue is increased by protraction if the slope of the dose-protraction curve is low in the case of tumors. Clinical experience generally leads to the rejection techniques using massive doses of radiation and confirms the practical advantages of protraction of doses. The mechanism of the differential effect can be interpreted from a difference in the shape of the initial, nonexponential part of the survival curves of the various cell populations. Therefore, the influence of protraction must depend upon the linear energy transfer (LET) of the radiation and it can be modified by endogenous and exogenous factors. As a rule, the biological effect tends to increase, when spacing between the irradiation sessions is progressively lengthened while protraction and dose remain the same. Various observations suggest that the most important role is played by the number of sessions rather than by their spacing (therefore also by protraction). (TCO)

27146 LATE PATHOLOGICAL EFFECTS OF ACUTE IRRADIATION IN MAMMALS. Carissimo Biagini (Università, Rome). Laval Med., 34: 155(Jan. 1963). (In English)

From Symposium on Radiosensitivity, Laval Univ., Quebec, Sept. 1962.

27147 LATE EFFECT OF CONTINUOUS IRRADIATION. L. F. Lamerton (Royal Cancer Hospital, London). Laval Med., 34: 156-62(Jan. 1963). (In English)

From Symposium on Radiosensitivity, Laval Univ., Quebec, Sept. 1962.

Changes in the cellular constituents of intestine and bone marrow were investigated in rats continuously exposed to Cs^{137} γ radiation. Labeling of the cells with thymdine-H^3 was used to follow cellular proliferation. Even at the highest dose rate used (415 rad/day) there was no collapse of the gut. Within the first day or so the cell population of the crypts fell to about half its normal value and remained so until the animal died from bone marrow failure at 10 days or so. Most striking was the rapidity with which the equilibrium state was achieved and the relatively small cell population change (down to 41% of normal) for the high dose rate of 415 rad/day. At 176 rad/day the crypt population was about 51% of normal at 5 days, and at 84 rad/day was 71% of normal. The number of dividing cells per crypt fell and then rose during continuous radiation. However, the fact that the initial percentage labeling of the crypt cells, following tritiated thymidine injection, was about the same after 5 days of irradiation as in the normal indicates that there was no substantial change in generation time. The generation time was the same, about 10 hr, for normal cells, for cells that were subjected to continuous irradiation at 415 rad/day for 5 days, and for cells in animals that were recovering from a period of continuous irradiation. The response of the blood-forming organs to continuous irradiation was in contrast with that of the gut. At 415 and 176 rad/day there was a rapid collapse of bone marrow. Not until a dose rate of 50 rad/day was reached did the peripheral blood count indicate the maintenance of a steady or near-steady state. There was also a steady state achieved in the bone marrow population at 50 rad/day; it is of the order of several weeks, much longer than for the gut. It is

suggested that the greater capacity for rapid regeneration in the gut compared with bone marrow is an important factor. (TCO)

27148 LATE EFFECTS OF CONTINUOUS IRRADIATION: THE RELATION OF HEMATOLOGICAL INJURY TO LETHALITY. George A. Sacher (Argonne National Lab., Ill.). Laval Med., 34: 163-8(Jan. 1963). (TID-17645) (In English)

From Symposium on Radiosensitivity, Laval Univ., Quebec, Sept. 1962.

Experiments are reported in which 5000 mice, both sexes of a first generation hybrid, were irradiated with 22 treatment levels ranging from 5 to 2500 r/day. Treatment began at 100 days of age and continued daily for the remainder of life. The relation of mean after-survival time to accumulated dose shows that the mean accumulated dose (MAD) is high at the shortest survival times. It decreases to a well defined minimum at 7 days, followed by a brief rise and more extended fall to a second minimum at about 18-20 days, followed by a rise to about 200 days that is interrupted by a shallow but significant minimum at about 40 days. Beyond 200 days natural aging takes over, and MAD decreases steadily, to reach zero at the control survival time. If the reciprocal of daily dose is plotted as ordinate against mean after-survival time on the abscissa, the curve increases to the right, but in a series of steps with the successive rises centered at about 5, 13, and 40 days. The curve is interpreted as describing the time-course of accumulation of potentially lethal injury in a population given a constant daily dose. The points of steepest rise are times of most rapid accumulation of injury. The pronounced peaks present at 5 and 13 days correspond respectively to the syndromes of intestinal and leukopoietic damage following a single radiation dose. The third peak at 40 days has no corresponding single-dose syndrome because the third process is less radiosensitive than the first 2 and hence rarely has a lethal outcome in animals that survive the first 2. It is conjectured that the 40-day process relates to disturbance of the circulating red cell level, and evidence in support of this is reported. The pattern of change in the hemoglobin levels of continuously irradiated mice shows a progressive decrease at the highest daily dosages, an arrest or slight rise at 22 days at lower levels, and almost complete compensation at the lowest levels. The decrease of red cell count with age was shared by control and irradiated groups, and the very considerable depression of red cell count occurred at dosage levels without depression of hemoglobin. This suggests that the circulating hemoglobin level has a stronger homeostatic control than does red cell level, or a lesser vulnerability to age and radiation damage, or both. The absolute reticulocyte counts show a rebound at about 20 days, and the increase over controls beyond 100 days is striking. The tendency of almost all elements (lymphocytes, platelets, neutrophils, etc.) to rebound at 22 days requires explanation in terms of systemic physiology rather than of intracellular processes. It is proposed that a phenomenon of radiation lethality observed in the 20–40-day period after beginning of exposure is due to the action of sex hormones and somatotropic hormone. It is also postulated that the blood element most gravely injured at a given time is the most important contributor to lethality at that time. Of the elements studied, only the granulocyte level has any strong involvement at 11 days. The hematocrit showed maximum gravity of injury at 47 days, which is close to the maximum at 40 days in the lethality process. Lymphocytes show no peaks of gravity of injury, but the progressive depression may lead to diseases arising from lymphopenia late in life. (TCO)

27149 STUDIES OF THE LATE EFFECTS OF INTERNAL IRRADIATION BY RADIOACTIVE STRONTIUM IN THE RAT. David S. Kahn, Joginder S. Makhani, and Stanley C. Skoryna (McGill Univ., Montreal). Laval Med., 34: 169-83 (Jan. 1963). (In English)

From Symposium on Radiosensitivity, Laval Univ., Quebec, Sept. 1962.

The late effects of radioactive Sr on bone, the dose-response relation, and the effects of modifying factors were studied in the rat, which was selected because growth persists long into adult life in many bones. Thus as bone growth occurs in relation to the epiphysis, an appreciable amount of mineral continues to be deposited in this newly formed bone. Sr^{89} was administered intraperitoneally at monthly intervals in total doses of 4.4 mc/g body wt for a 6-month period. Sixty-three percent of the animals survived the minimal latent period for tumor production. The basic tissue changes observed in bone were: disturbance of osteogenesis, fibrosis of the marrow, cellular proliferation, and tumor formation. These changes occurred to the greatest extent in the metaphyseal region, which represents the area of maximum bone formation; to a lesser degree they could also be found in relation to endosteal and periosteal surfaces. The most extreme fibrotic changes, replacing the normal hematopoietic marrow, occurred in the metaphysis. Fibrosis was of a relatively acellular type, with abundant reticulum fibers and only minimal collagen formation. In the metaphyseal area there was a marked decrease in the number of bony trabeculae, indicating a depression of osteogenesis. Changes secondary to decreased mechanical stability, such as healing microfractures and endosteal and periosteal new bone formation, were also found. Fibrosis observed in these animals possibly was related to the primary effect of irradiation; on the other hand, it may represent merely a repair tissue compensating further lack of bony trabeculae. Foci of cellular proliferation were present in the metaphysis as well as in proximity to endosteal and periosteal surface. In these foci, cells with large hyperchromatic nuclei and mitotic figures (some of them atypical) were almost uniformly present. The principal cells in these groups did not resemble either normal osteoblasts or fibroblasts; some of the larger collections of these cells showed evidence of invasion and destruction of normal structures. Although in all the animals surviving the minimal latent period, on microscopic examination, neoplastic changes were found in their bones, only in 89% were tumors demonstrable grossly or by x-ray studies. Many of these animals had multiple tumors and the majority of them developed pulmonary metastases. The distribution of gross tumors in these animals occurred in the following order of frequency; upper end of tibio-fibula, vertebrae, humerus, femur, and sacrum. No tumors or radiation osteitis were observed during the period of observation in animals which received single injections of doses ranging from 0.001 to 1 μc Sr^{89} per g body wt. After administration of 2 μc per g body wt or higher doses, malignant bone tumors were found in some rats which survived for 1 year or longer. However, as the mortality in these groups was high, the incidence of malignant bone tumor formation could not be clearly defined because of variability of survival time. When 5 μc/g body wt was administered as a single injection, all animals died in the immediate post injection period. Other groups received intermittent doses of 0.1 μc intraperitoneally per g body wt twice weekly for variable periods of time. After 40 injections (total dose 4 μc/g body wt) the mortality was increased appreciably and tumors were frequent in the surviving animals. The results indicate that a total dose of 5 μc/g

body wt, administered either as a single dose or in repeated injections results in almost 100% mortality. (H.H.D.)

27150 SOME RESULTS OF CHRONIC INTERNAL IRRADIATION IN HUMANS. Carye-Belle Henle, Lester Barrer, Hymen Fisher, and Robert Bonda (New Jersey State Dept. of Health, Trenton). Laval Med., 34: 184-8(Jan. 1963). (In English)

From Symposium on Radiosensitivity, Laval Univ., Quebec, Sept. 1962.

Studies are reported on workers in the radium luminous dial industry who incorporated radioactivity 20 to 45 years ago by ingestion and inhalation of Ra^{226} and Ra^{228}. The present observations are based upon the results of 104 individuals, the average age of which is 64 yr, with a range of 41 to 82 yr. Estimates of body burdens extend from the lowest measurable quantity of 0.0042 to 1.67 μC Ra^{226}. Extensive laboratory and physical examinations revealed few striking deviations from those expected in individuals of this age group. An increased erythrocyte sedimentation rate and some alterations of serum globulin pattern were frequently found. There was one case each of myeloid leukemia, myelosclerosis, and agnogenic myeloid metaplasia. In addition there were 2 cases of osteosarcoma of tibia; body burdens of 1.67 and 0.6 μC Ra^{226} were present in the cases. Other pathologic findings associated with fairly high body burdens were: osteoarthritis, cortical thinning of bone, fractures, and areas of bone resorption. Changes were most frequent in calvarium and the long bones of the forearms and legs. It was estimated that the body burdens are presently < 1% of the original levels. Dental examinations also showed evidence of bone resorption. Some of the pathologic changes, including tumor formation, occurred at low as well as high burden levels. (H.H.D.)

27151 MAN AND RADIATION. P. Genaud. Med. Reserve (Paris), 57: 137-48(Sept.-Oct. 1961).

A review is presented on the biologic effects of ionizing radiation on man. (H.H.D.)

27152 SURVIVAL OF MAMMALIAN CELLS IRRADIATED IN DIFFERENT PHASES OF LIFE-CYCLE AS EXAMINED BY AUTORADIOGRAPHY. W. C. Dewey and R. M. Humphrey (Univ. of Texas, Houston). Nature, 198: 1063-6(June 15, 1963).

The radiosensitivity of cells at various mitotic phases was investigated in cultures of rat L cells exposed to a complete range of radiation doses. The cells were labeled with tritiated thymidine and after x irradiation and incubation for various time intervals were examined by phase contrast microscopy and radioautography. Results were compared with those from similar experiments using hamster cells. Results using mouse L cells differed from those using hamster cells and those from previous studies using HeLa cells. A relation between chromosomal damage and cell survival was observed. (C.H.)

27153 CORRELATION OF CHROMOSOME SIZE AND RADIOSENSITIVITY. Resa Wakonig-Vaartaja (Univ. of Adelaide). Nature, 198: 1105-6(June 15, 1963).

Results of studies on the radiosensitivity of 3 pairs of closely related plant species, each having the same number of chromosomes, indicate a clear relation between the incidence of x ray damage and average nuclear and chromosome volumes. (C.H.)

27154 THE EFFECTIVE MECHANISM OF SEROTONIN AS RADIATION PROTECTOR. Ulrich Hagen and Kurt Flemming (Universität, Freiburg i. B.). Naturwissenschaften, 50: 303(1963). (In German)

The cell count in the bone marrow of mice of both sexes was determined for the first three days after 800-r whole-body irradiation. Half of the animals received serotonin 5 min before exposure. The results are tabulated and show that in the first 12 hr the cell count of the protected animals is only slightly higher than in the unprotected animals. Statistical differences can be measured after 24 hr. On the second day the cell number of the unprotected animals decreases still further, whereas the cell number of the protected animals remains the same. This shows that cells are almost completely protected from radiation damage by serotonin. (J.S.R.)

27155 CANCER PRODUCTION BY APPLICATION OF DIETHYLNITROSAMINE AND X RADIATION TO RATS. D. Schmaehl (Universität, Bonn), C. Thomas, and E. Stutz. Naturwissenschaften, 50: 308-9(1963). (In German)

The combined effect of the carcinogenic agent diethylnitrosamine (DENA) and whole-body x irradiation was tested on Wistar rats of both sexes. One group received DENA only. The second group received, 24 hr before starting the DENA treatment, a single whole-body x irradiation of 320 r. The DENA treatment was continued until all animals developed liver cancers. The hepatocellular carcinomas of both groups were morphologically the same. The animals receiving only DENA required 690 ± 53 mg/kg for carcinoma production (D_{50}), in good agreement with earlier studies. The induction time was 230 ± 18 days. For the animals receiving whole-body exposure, the D_{50} was 674 ± 45 mg/kg and the induction time was 225 ± 15 days. The variation is not statistically significant. (J.S.R.)

27156 RADIOPROTECTIVE EFFECT OF ETHYL STEARATE. Kurt Flemming (Heiligenberg-Instituts, Heiligenberg/Baden, Ger. and Universität, Freiburg i. B.). Naturwissenschaften, 50: 332(1963). (In German)

White mice, 48 hr after intravenous injection of 20 mg of ethyl stearate, were exposed to whole-body x irradiation at 590, 650, and 750 r. The survival after 30 days showed a significant variation between the treated and untreated mice, irradiated with 650 r. The survival rate increased from 23 to 68%. No protective effect was found for the mice exposed to 750 r. At 590 r, the survival rate increased from 50 to 75%. The significance of these results is discussed with respect to the role of the RES activity. (J.S.R.)

27157 THE DOSE DEPENDENCE OF THE RADIOINDUCED NUCLEOPROTEIN DECREASE IN CELL NUCLEI OF THE LIVER, SPLEEN, AND THYMUS. Hanna Ernst (Heiligenberg-Instituts, Heiligenberg/Baden, Ger.). Naturwissenschaften, 50: 333(1963). (In German)

The dose dependence of the radioinduced nucleoprotein loss was investigated in white male rats in the first four hours after irradiation. The rats were exposed to whole-body irradiation at doses of 50, 200, and 1000 r. At various times, up to four hours, the rats were sacrificed and the cell nuclei were extracted. The results are shown graphically and indicate no dose dependence in the nucleoprotein loss in the liver. The lymphatic cells show a probable dose-dependent loss at doses of 200 r and under. The nucleoprotein loss during the first four hours appears to be, in the lymphatic and parenchymatic nuclei, an extensive tissue and dose nonspecific reaction to the irradiation. (J.S.R.)

27158 SPROUT INHIBITION AND RADIOMIMETIC PROPERTIES IN IRRADIATED POTATOES. V. L. Chopra and M. S. Swaminathan (Indian Agricultural Research Inst., New Delhi, India). Naturwissenschaften, 50: 374-5(1963). (In English)

Potato tubers of the up-to-date variety were irradiated with 20 krads of γ rays using a 200-C Co^{60} source. The irradiated tubers were cold stored and then allowed to sprout. Sprouting was completely inhibited. Both irradiated and unirradiated tubers were used for the preparation of mash on which germinating barley embryos were planted. In root meristems from embryos grown on normal potato mash, 9 cells had micronuclei out of 3022 cells. There were 64 micronuclei out of 2811 cells studied in root tips grown on irradiated potato mash. (J.S.R.)

27159 RECENT OBSERVATIONS ON RADIATION GENETICS AND THEIR IMPORTANCE IN THE EVALUATION OF GENETIC RADIATION DAMAGE. F. H. Sobels (Universiteit, Leiden). Ned. Tijdschr. Geneesk., 106: 794-805(Apr. 14, 1962).

27160 HEMATOLOGICAL EFFECTS OF ROENTGEN RADIATION. E. F. Scheller. Nucl. Hematol., 2: iii-vi (June-Aug. 1963). (In German)

Methods using electron microscopy, dark-field ultramicroscopy, and color comparisons were developed to determine the effects of radiation on blood. The effects of x radiation on blood smears were investigated and photographed. The radiation doses were varied from 50 to 500 r. Injuries appeared first at 100 r. The linear increase of the dose-effect relation depended on the dose, its duration and biological sensitivity. Above 400 r direct injury to the cytoplasmic structural elements appeared. Animal experiments using hamsters were carried out to determine the radioinduced differences in blood before and after total-body irradiation. Lethal factors originated at doses above 500 r. (M.C.G.)

27161 TODAY'S RADIOACTIVITY AND MEDICAL, HEMATOLOGICAL DATES. S. Schmidt. Nucl. Hematol., 2: ix-xi(June-Aug. 1963). (In English)

Radiation dosages from the medical and industrial field, cosmic rays, and nuclear explosions are considered and their effects on organisms are discussed. Biologic and chemical products that protect sound tissue more efficaciously and permit a cancer victim to be subjected to a higher radiation dose are reported. (C.E.S.)

27162 MEDICAL USE OF REACTORS. G. L. Brownell and W. H. Ellett (Massachusetts General Hospital, Boston). Phys. Med. Biol., 8: 125-48(June 1963).

Medical uses of reactors are reviewed. It is concluded that, at the present time, the production of radioisotopes is the most important application of reactors to medical science. Developments in this area will probably be towards the production of short-lived isotopes for specialized purposes. Activation analysis shows promise of becoming an important analytical procedure in medicine as well as other scientific areas. Although in many ways the technical problems are more difficult than with machine sources, the direct use of radiation from a reactor for therapeutic purposes is a real possibility. Neutron capture therapy would appear, at least in theory, to offer an ideal way of combining the advantages of direct physical application of radiation with the physiological concentration of isotopes. (C.H.)

27163 THE CONSTRUCTION AND USE OF A GUARDED-FIELD CAVITY IONIZATION CHAMBER FOR THE MEASUREMENT OF SUPERVOLTAGE RADIATION. L. A. W. Kemp and Barry Barber (London Hospital Research Labs.). Phys. Med. Biol., 8: 149-60(June 1963).

The merits of the guarded-field type of ionization chamber are compared with the conventional type of thimble chamber, with outlines of the electrostatic field distributions. Details of the mode of construction of a practical and robust guarded-field chamber are given. With exposure dose rates of the order of 100 r/min, for which the chamber was designed, it becomes feasible and advantageous to use the chamber in conjunction with a high-sensitivity moving-coil galvanometer instead of a Townsend Balance. A suitable galvanometer is described, together with a calibrating network which enables the ionization current to be determined by a null-type matching procedure. The results of Boag's theory of general recombination in a parallel plate type of chamber are summarized and it is shown that, as predicted by the theory, a plot of the current, j, against the square of the ratio of the current to the polarizing voltage $(j/V)^2$, yields a straight line which can be extrapolated to obtain the saturation current. The result of an absolute measurement of the exposure dose rate of the London Hospital cobalt unit is compared with the output as determined by a Victrometer dosemeter calibrated at the National Physical Laboratory. (auth)

27164 A DIGITAL DOSEMETER FOR USE IN X-RAY THERAPY. B. W. Watson (Regional Medical Physics Dept., Sheffield, Eng.). Phys. Med. Biol., 8: 161-4(June 1963).

A digital dosemeter is described for controlling the dose delivered in x ray therapy. The integration is linear up to 30 steps per minute and over a large range of ionization currents, provided the input capacitance is greater than 100 picofarad. The digitizer is a measuring moving-coil relay and the x ray set is controlled by a predetermining counter. (auth)

27165 SOME ASPECTS OF RADIOSTRONTIUM DOSIMETRY. G. W. Dolphin and I. S. Eve (United Kingdom Atomic Energy Authority, Harwell, Berks, Eng.). Phys. Med. Biol., 8: 205-14(June 1963).

The current methods of the dosimetry of radiostrontium are critically reviewed with reference to the models proposed by Dolphin and Eve (1963) and the most recent experimental measurements of body retention of the alkaline earths. It is concluded that the current ICRP (1959). Recommendations for the $(MPC)_\alpha$ and $(MPC)_\omega$ are less restrictive by a factor of around 3 or 4. (auth)

27166 THE EFFECT OF IONIZING RADIATION ON NUCLEAR AND ANUCLEAR ERYTHROCYTES. V. Sebestik, J. Jelinek, Z. Dienstbier, and L. Viktora (Inst. of Hematology and Blood Transfusion, Prague). Physiol. Bohemoslov., 11: 510-17(1962).

The effect of high doses of x radiation (40000 r) on human, rabbit, and rooster erythrocytes in vitro was studied. Immediately after irradiation of blood no change in plasma hemoglobin and osmotic resistance of the cells was observed. Irradiation had no significant effect on survival of Cr^{51}-labeled red cells irradiated in vitro and then reinjected. Only following 24-hr incubation of irradiated blood samples at body temperature did a rise in plasma hemoglobin content and a fall in osmotic resistance occur in irradiated erythrocytes in comparison with controls. No marked differences between nuclear (avian) and anuclear (mammalian) erythrocytes were observed in these responses. The relatively little difference between reactions of mammalian and avian red cells may be explained by the fact that the former contain a nucleus that no longer divides. The cell also lacks the basophil cytoplasmic substance and a true nucleolus, and the nucleus has a mature chromatic structure. The effect of irradiation became apparent only after incubation at body temperature when physiological and metabolic functions were already impaired as the result of isolation even in nonirradiated red

cells. It was concluded that avian and mammalian red cells are injured in vitro by intense irradiation but the injury is such that the biological value of the cells is not greatly affected. (TCO)

27167 SUBACUTE MYELOID LEUKEMIA FOLLOWING ROENTGEN IRRADIATION. Krystyna Golacka and Zofia Rupniewska (First Clinic of Internal Medicine, Lublin, Poland). Polski Tygod. Lekar., 17: 188-90(Jan. 29, 1962).

Development of leukemia in a 30-yr-old man 5 yr after radiotherapy for rheumatoid arthritis is described. (H.H.D.)

27168 RELATIVE ULTRAVIOLET SENSITIVITY OF DIFFERENT PHASES IN THE CELL CYCLE OF CHINESE HAMSTER CELLS GROWN IN VITRO. Ronald M. Humphrey, William C. Dewey, and Ann Cork (Univ. of Texas, Houston). Radiation Res., 19: 247-60(June 1963).

Chromosomal damage after UV irradiation of an in vitro mammalian cell line (Chinese hamster) in different phases of the life cycle was determined. The cells were pulse-labeled with tritiated thymidine immediately before irradiation (100 ergs/mm^2), and autoradiographs were prepared from samples taken every 2 hours. Metaphases were classified as labeled or unlabeled and were analyzed for breaks and exchanges. Cells in DNA synthesis at the time of irradiation suffer about ten times the chromosomal damage of cells in G_1 and G_2 phases. Furthermore, for both G_1- and S-phase cells which divide from 10 to 16 hours after irradiation, the greatest fraction of breaks (70 to 90%) is elicited as chromatid exchanges; whereas in G_2- and S-phase cells which divide from 2 to 8 hours after irradiation, a smaller fraction of damage (about 40%) results in chromatid exchanges. The frequency of chromosome exchanges in irradiated cells is not significantly different from that in control cells. The results were compared with those obtained for ionizing radiation, and significant differences were noted. For ionizing radiation, S-phase cells sampled both early and late after irradiation sustained the same amount of damage, and in G_1 cells 70% of the exchanges were due to dicentrics (chromosome exchanges). For UV radiation cells in S phase which were sampled 10 to 16 hours after irradiation sustained about 25 times as much damage as did cells in S phase which were sampled prior to 8 hours, and in G_1 cells only 19% of the exchanges were due to dicentrics. These findings are consistent with the hypothesis that the chromosome, although morphologically single, consists of two subunits which separate as the cell enters the S phase. (auth)

27169 AGE OF THE MOTHER AND PREVIOUS BREEDING HISTORY AND THE INCIDENCE OF X-RAY-INDUCED CONGENITAL ANOMALIES. Robert Rugh and Marlis Wohlfromm (Columbia Univ., New York). Radiation Res., 19: 261-9(June 1963).

Ova production as measured by average implantation number in young (primipara) mice as compared with old breeders (of 14± months of age) is essentially the same, when they are mated to young and virile males of the same strain. X irradiation of embryos at 1.5 days (two-cell stage) showed a significant difference between fetuses of the young and old females with respect to the percentage of normals (higher in the young) and the percentage of resorptions and congenital defects (higher in the older females). X irradiation of embryos at 8.5 days of gestation (during neurogenesis) reduced the percentage of normals at lower levels of x irradiation, and to a much greater degree among the old breeders than among the young mice. There were twice as many intra-uterine deaths and resorptions among the older mice after 200 r, but about one-third as many gross central nervous system anomalies among the old breeders. This disparity is reduced when it is emphasized that, since the old breeders lose more embryos, in utero, there are fewer survivors to develop persisting congenital anomalies. If the percentage of central nervous system anomalies among survivors only is computed, the disparity still shows a preponderance among the younger mice, but the relation is reduced to 26.0 and 23.4%. Whether the disparity in reaction of embryos of young and old mice is due to aged eggs or to senile physiology of the mother, or to both factors, is not clear. Since the unirradiated controls of these two ages of mice do not show the same degree of disparity, it seems unequivocal that the x irradiated embryos of the old females are relatively the more radiosensitive, in terms of mortality, but the embryos of the young mice are the more sensitive in terms of surviving morbidity. (auth)

27170 CONTINUOUS LOW-DOSE RADIATION EFFECTS ON SUCCESSIVE LITTERS OF THE ALBINO RAT. Sidney O. Brown, George M. Krise, and Henry B. Pace (Texas Agricultural and Mechanical Coll., College Station, Texas). Radiation Res., 19: 270-6(June 1963).

Groups of 10 mature female rats of the Holtzman strain were exposed continuously to γ radiation levels of 0, 2, 5, 10, and 20 r daily after conception. There were no essential differences in litter size, or in number of offspring born, between four successive litters produced while the mothers remained continuously in the γ radiation field. There was no significant variation in the first six litters born at the 0-r, 2-r, 5-r, and 10-r daily radiation levels; however, at 20 r daily only one offspring was born in the fifth litter, and none in the sixth. No anomalies were observed at any level of the radiation used in these experiments, except for a slight decrease in average weight of the newborn. Offspring from the third litter born to mothers continuously in the radiation chamber were shown to be fertile in those groups which received 0, 2, and 5 r of γ radiation administered over a 23-hour period daily. The corresponding animals receiving daily doses of 10 and 20 r from the time of conception were sterile when bred together or with known fertile unirradiated males. (auth)

27171 PROTEIN COMPOSITION AND GROWTH-PROMOTING ACTIVITY OF THE SERUM AFTER WHOLE-BODY X-IRRADIATED AT DIFFERENT AGES. André D. Glinos (Walter Reed Army Inst. of Research, Washington, D. C.). Radiation Res., 19: 286-97(June 1963).

The composition of the serum proteins of the rat, evaluated 24 hours after irradiation by paper electrophoresis, on the basis of an internal standard of comparison, showed a significant, dose-dependent increase in the α_2-globulin fraction. The growth-promoting activity of the serum, evaluated 24 hours after irradiation by incorporating the serum in the medium of replicate cultures of the L strain of mouse fibroblasts, did not show any significant difference from the activity of serum from sham-irradiated control rats of the same age. These results were compared with available data pertaining to other mammals, and their implications with respect to the interpretation of the distant, or abscopal, effects of radiation were discussed. (auth)

27172 ANALYSIS OF TEETH AND BONES FOR ALPHA-EMITTING ELEMENTS. Edward P. Radford, Jr., Vilma R. Hunt, and Dwyn Sherry (Harvard School of Public Health, Boston). Radiation Res., 19: 298-315(June 1963).

A method for the analysis of a single tooth and small samples of bone for Po^{210}, Ra^{226}, and Ra^{224} is described. It

was found to give results in good agreement with those obtained by other laboratories using different methods. Radium-224 was distinguished from Ra^{226} by nonrandom decay of its daughters, or by analysis of the time course of growth or decay of α-activity. There was quantitative chemical recovery of Po^{210} (counting efficiency 51% with 2 π geometry and backscatter of 2%). Chemical recovery of radium was approximately 74%; with a self-absorption factor of 0.90, backscatter factor of 1.02, and geometry of 0.50, the combined separation and counting efficiency for radium was 33%. The coefficient of variation for chemical recovery was 7% for polonium and 9% for radium. The chief advantages of the method are its simplicity and the relatively short time necessary for chemical analysis. Simultaneous analyses of Po^{210}, Ra^{226}, and Ra^{224} can be done on the same small sample of calcified tissue. An ash content of 2 gm or less is suitable; for larger samples some modification of the method might be necessary to avoid $CaSO_4$ precipitation with the initial precipitate in the radium procedure. (auth)

27173 RADIOSENSITIVITY AND THYROID FUNCTION IN MICE. Takehiko Tsuchiya (National Inst. of Radiological Sciences, Chiba, Japan); Jun-Ichiro Hayakawa, Susumu Muramatsu, Hideo Etō, and Tsutomu Sugahara. Radiation Res., 19: 316-23(June 1963).

Thyroid function was compared in three inbred strains of mice, RF, CF1, and C57BL/6, whose radiosensitivity was found to be different. The correlation between functional level of the thyroids and radiosensitivity may indicate that the difference in radiosensitivity is due ω a physiological difference in the thyroid function and, accordingly, the basal metabolic rate. Protection against radiation was clearly observed on administration of antithyroid agents in a strain with physiologically high thyroid activity. Similarly, sensitization to radiation was demonstrated on the administration of thyroid hormone in a strain with physiologically low thyroid activity. (auth)

27174 CYSTEAMINE PROTECTION OF X-RAY-INDUCED DYSPLASIA IN MOUSE HAIR. Frederick D. Malkinson, Melvin L. Griem, David M. Phillips, and Peter H. Morse (Cancer Research Hospital, Chicago and Univ. of Chicago). Radiation Res., 19: 324-30(June 1963).

Cysteamine reduces the incidence of radiation-induced dysplasia in the growing hairs of mice. The dose reduction factor of about 1.5 is comparable to the protection afforded by cysteamine in other radiobiological studies. The administration of cysteamine immediately after x ray exposure results in slightly increased hair dysplasia. (auth)

27175 THE ROLE OF OZONE IN RADIATION AVOIDANCE IN THE MOUSE. Dorothy C. Peterson and Howard L. Andrews (National Institutes of Health, Bethesda, Md.). Radiation Res., 19: 331-6(June 1963).

Mice subjected to ozone in one-half of a test cage show a decreased activity and an avoidance reaction similar to that seen with radiation. With ozone alone, the reaction is elicited only when the environmental concentrations are several times as great as those produced by an effective x ray beam. No change in the radiation avoidance reaction is observed when the oxygen concentration in the cage is raised to 95%. (auth)

27176 CHROMOSOME ABERRATIONS IN LIVER CELLS IN RELATION TO THE SOMATIC MUTATION THEORY OF AGING. Howard Curtis and Cathryn Crowley (Brookhaven National Lab., Upton, N. Y.). Radiation Res., 19: 337-44(June 1963). (BNL-6471)

The percentage of cells containing chromosomal aberrations present in regenerating liver of mice was scored as a function of age in normal mice, age for mice subjected to chronic γ irradiation, time after a single dose of x rays, and time after a single dose of neutrons. Normal mice develop chromosomal aberrations linearly with age, and mice subjected to chronic γ irradiation develop them at a greater rate. In comparing acute x irradiation with chronic γ irradiation, it is apparent that chromosome aberrations result from multihit events; in other words, chromosome healing is possible after small doses. Chromosomal damage seemed more severe for neutrons than for x rays for equal acute damage, and recovery from neutron irradiation was much slower. These results strongly support the somatic mutation theory of aging, and it is concluded that this theory alone can explain the known facts of aging and radiation-induced aging. (auth)

27177 THE METHOD OF A COMPETITIVE SCAVENGER IN RADIATION CHEMISTRY. V. N. Shubin and P. I. Dolin (Electrochemical Inst., Moscow). Radiation Res., 19: 345-58(June 1963).

The method of a competitive scavenger is described in a general way. The examples given show the great possibilities of this method for the determination of the mechanism of the processes of radiation chemistry. The most reliable results can be obtained when the transformation of the radicals has been carried out. At present, this method is one of the few which can provide a sound concept of the mechanism of the processes occurring in the system on irradiation. (auth)

27178 EFFECT OF X-RAY ON ANTIGEN METABOLISM IN THE RABBIT. H. M. Rubinstein and H. Perikh (Michael Reese Hospital, Chicago and Chicago Medical School). Radiation Res., 19: 368-83(June 1963).

Bovine serum albumin conjugated to S^{35}-sulfanilic acid was injected intravenously in standard doses into three groups of rabbits: Group A (control): normal rabbits; group B: rabbits injected 18 hours after 450 r of whole-body irradiation (primary antibody response inhibited); and group C: rabbits injected immediately after 450 r of whole-body irradiation (primary antibody response not inhibited). The plasma, liver, spleen, lymph node, kidney, appendix, and lung were studied for radioactivity and protein content at 1, 7, and 21 days after injection. In all groups, the retention of radioactivity in the tissues decreased with time. The overall metabolism of the antigen by lymph node was retarded when compared to other tissues. There were no differences among all three groups in total-organ retention of antigen at all time intervals. When group A was compared to groups B and C, there were certain differences when antigen retention was expressed in terms of tissue weight or protein content. These differences were attributed to organ-weight changes secondary to irradiation. These differences did not appear when group B was compared to group C. The cells responsible for the retention and degradation of the bulk of injected antigen are not inhibited by irradiation under conditions which inhibit the primary antibody response. When large amounts of antigen are injected, only a small fraction may be important in induction of antibody formation. (auth)

27179 THE ACTION OF MONOCHROMATIC ULTRAVIOLET RADIATION ON LUMINESCENCE IN ARMILLARIA MELLEA. Martha D. Berliner (AVCO, Wilmington, Mass.). Radiation Res., 19: 392-401(June 1963).

The effects of different ultraviolet wavelengths and exposures on the light emission of cultures of the fungus Armillaria mellea are reported. Irradiation at 2800 A

caused the only permanent damage to both respiratory activity and growth. There was a consistent increase in the light emission during irradiation at 2800 A, and a consistent decrease at 3100 A and 3660 A. All wavelengths were effective in causing a temporary intense stimulation of bioluminescence after removal of the ultraviolet source. There is a maximum light increase which varies with the wavelength. (auth)

27180 HYDROGEN PEROXIDE YIELDS FROM COBALT-60 GAMMA IRRADIATION OF ALKALINE SOLUTIONS. Mary-Louise Rothschild and William T. Tsukamoto (Univ. of California, Los Angeles). Radiation Res., 19: 402-8(June 1963).

The chain-transformation reaction of ferriprotoporphyrin, FPP, was used to determine the observed initial yield of hydrogen peroxide, $G(H_2O_2)_{obs}$, and the initial yield of total chain-initiating agents, G(R), from cobalt-60 γ-irradiation of aerated alkaline solutions, pH 7.7 to 14, by comparing the initial yields of transformation product from the thermal hydrogen peroxide reaction with those from the postirradiation and irradiation reaction of FPP, respectively. The values for $G(H_2O_2)_{obs}$ and G(R) were found to be approximately constant for alkaline solutions at pH <10.5, with averages of 1.5 and 1.03 molecules per 100 ev, respectively. The values for G(R) above pH 10.5 and those for $G(H_2O_2)_{obs}$ above pH 12.5 were found to increase to maxima at pH 13.3, with values of 6.25 and 4.1, respectively. The values for G(R) in alkaline solutions at pH <10.5 are essentially equal to the value for F + 2E in neutral solution, where F + E is the yield of hydrogen peroxide from water decomposition and E is the yield of hydrogen peroxide from the reduction of dissolved oxygen by the H atoms formed in excess of OH radicals. It is proposed that, in alkaline solutions at pH <10.5, FPP reacts successively with OH radicals and H atoms (or HO_2 radicals), resulting in their recombination and unchanged FPP. It is further proposed that, in alkaline solutions at pH >10.5, new radical species are formed from water decomposition, which presumably do not react in a reversible reaction with FPP, but rather augment the chain-transformation reaction. (auth)

27181 DISTURBANCES IN THE TRITIUM CONTENT IN ORGANS AFTER IRRADIATION. A. Zuppinger, G. Poretti, K. Schwarz, P. Zaoralek, and H. Aebi (Université, Bern). Radiol. Clin., 32: 402-10(1963). (In English)

The whole body irradiation of Swiss mice produced a disturbance in the content of tritium, injected intraperitoneally as tritiated water, in fresh as well in dried organs. The tritium content after irradiation follows a biphasic course that cannot be explained by disturbances in the uptake or by elimination of water only. Moreover there is an indirect radiation effect on the nonirradiated skin of a local irradiated animal. (P.C.H.)

27182 STUDIES OF RADIOPROTECTIVE AND RADIOSENSITIZING CHEMICALS. IV. COMPARATIVE STUDY OF THE LETHALITY OF TOTAL-BODY IRRADIATIONS ON TWO STRAINS OF MICE. S. Neukomm. Radiol. Clin., 32: 417-28(1963). (In French)

In males of 2 pure strains of albino mice Swiss E and R_3 a definite difference of radiosensitivity was found, the R_3 being more radiosensitive. In the Swiss E, the females are less radiosensitive than the males. It was indicated that the conception of a relative biological effectivity, which changes with the energy of the radiation source, can also be applied to a comparison of x ray of 180 to 200 kv with those of 400 kv. Furthermore, it is very likely that the biological effect of equal radiation doses can be quantitatively different, although the x-ray apparatus appear to be identical. (P.C.H.)

27183 RADIATION PROCTITIS: ENDOSCOPY AND ENDOPHOTOGRAPHY WITH THE DEBRAY-SEGAL RECTOSCOPE. Eduardo Doerr, Francisco Souyet, Jorge Bonnefoy, Isaac Abusleme, and Ignacio Merino (Hospital J. J. Aguirre, Santiago de Chile). Rev. Med. Chile, 89: 104-9 (Feb. 1961).

Radiation-induced lesions of the rectum were followed in 40 women with uterine cervical carcinoma treated with radium or x rays. The rectoscope was used to observe the lesions, which in 30 cases developed into rectal stenosis and in 5 rectovaginal fistula. In 32 cases the symptoms of rectitis were first seen 4 months to 1 yr after radiotherapy. Endoscopy frequently showed a mucosanguinous exudate, and bleeding was sometimes caused by the procedure. Stenosis was of the annular type and usually near the anus. Areas of swollen rectal mucosa were present that were difficult to distinguish from tumors. In 14 cases, stenosis was so severe that the luminal diameter was 2 cm or less. It is suggested that the maximum dose tolerated by the rectum is ~8000 r but that rectal complications of radiotherapy of cervical cancer may accompany doses of 1600 r and higher. In some cases the rectitis may be fatal or it may cause severe and prolonged debilitation. (H.H.D.)

27184 TWO CASES OF THYROID SARCOMA AFTER IRRADIATION IN ADULTHOOD. Werner Wegmann (Universität, Zurich). Schweiz. Med. Wochschr., 92: 39-48 (Jan. 13, 1962). (In German)

A report was given of the development of 2 cases of lethal thyroid sarcoma, following radiation therapy for follicular adenocarcinoma in 2 female patients, aged 42 and 75. In both cases the follicular adenocarcinoma occurred years after strumectomy for a benign, nodular goiter. Sarcomas of the thyroid (a reticular cell sarcoma and an undifferentiated sarcoma) developed after latent periods of 5 and 12 years following intensive postoperative x irradiation. The total surface doses in the 2 cases were 10,559 and 5320 r. In the adult, the development of radiation-induced thyroid malignancies is probably associated with accessory factors. This association is shown by the sequence of events: adenoma; recurrence of adenoma; follicular adenocarcinoma. (H.H.D.)

27185 CANCER: RELATION OF PRENATAL RADIATION TO DEVELOPMENT OF THE DISEASE IN CHILDHOOD. E. J. Sternglass (Westinghouse Research Labs., Pittsburgh). Science, 140: 1102-4(June 7, 1963).

Experimental evidence indicating a linear response and the absence of a threshold for the development of childhood cancer and leukemia at total doses below 1 roentgen is contained in recent studies of prenatal diagnostic x ray exposure. Implications for the nature of the carcinogenic mechanism in the human organism are discussed, with emphasis on the possible effects of the ionizing radiation from iodine-131 and other short-lived isotopes. (auth)

27186 RADIATION REACTIONS AND RADIATION LESIONS IN THE EYE. F. Wachtler (Universität, Vienna). Wien. Klin. Wochschr., 73: 894-6(Dec. 8, 1961).

Radiation injury to the eye is discussed in terms of the induction of radiation cataract and retinopathy, and the early changes in the cornea and connective tissue of the eye. Evaluation of 100 reported cases shows that the minimum dose of x and γ rays required to cause cataract is ~200 r in a single exposure. With repeated doses spaced

over 3 weeks to 3 months the minimum total cataractogenic dose appears to be ~400 r. Lower doses of neutrons can cause cataract, while up to 8000-r doses from Sr^{90} may be tolerated. The lens appears to be 2 to 3 times more sensitive in young than in adult animals, and radiotherapy for eye tumors in children is more likely to induce cataract than similar treatment of adults. The retina is relatively less sensitive and a pathologic electroretinogram is obtained only at doses above 2000 r. After 10,000 r functional disturbances are more evident, and after 30000 r severe injury to the ganglion cells can be seen. Early changes in the cornea and ocular connective tissue are evident only after high doses; keratitis and conjunctivitis may follow 5000 r, and corneal ulceration after 10,000 r. Some clinical findings in patients given radiotherapy for various types of eye tumors are described. (TCO)

27187 ON THE PROBLEM OF CARCINOGENESIS BY ROENTGEN AND GAMMA RAYS. G. Fuchs (Zentral-Röntgen-Institut des Kaiser-Franz-Josef-Spitals, Vienna). Wien. Med. Wochschr., 111: 379-82(June 3, 1961).

Evidence is provided supporting the thesis that ionizing radiation acts as a primary carcinogen rather than inducing cancer by an indirect, nonspecific mechanism. Experience with the Japanese survivors of atomic bombing shows a direct cause and effect relation, and this is supported by similar evidence of a high incidence of leukemia and cancer in animals exposed to nuclear explosions. Further support for this thesis is provided by numerous reports relating leukemia in children to prenatal x-ray exposure in diagnostic tests on the mother and thyroid tumors in children irradiated for an enlarged thymus. (H.H.D.)

27188 STUDIES ON X-AGENT. XXVIII. INTERFERENCE OF GAMMA-RAYS WITH THE ACTION OF X-AGENT ON PROTEIN SOLUTION. Hideo Moriyama (Shonan Hygiene Inst., Kamakura, Japan). Yokohoma Med. Bull., 81-8 (Apr. 1963). (In English)

It is believed that the X-agent is a peculiar sort of electromagnetic radiation of a wide range of energies. Evidence is presented suggesting that gamma rays emitted from the radioactive isotope I^{131} can interact with the action of the X-agent on the turbidity of protein solutions. It was found that the gamma ray can interact with the X-agent, although the detailed mode of its action is not clear. The effect of the isotope could be demonstrated only when the X-agent was evidently demonstrable. (P.C.H.)

27189 THE ACTION OF CHLORDIAZEPOXIDE ON METABOLISM AND BODY TEMPERATURE OF THE MOUSE: DATA ON THE MECHANISM OF ACTION OF RADIOPROTECTIVE AGENTS. A. Locker (Universität, Vienna). Z. Ges. Exptl. Med., 136: 274-84(1962).

This drug, Librium or 7-chloro-2-methylamino-5-phenyl-1,4-benzodiazepine-4-oxide-hydrochloride, when given to mice in doses of 7.5 to 50 mg/kg had a biphasic effect on oxygen consumption. Consumption fell sharply 15 min after its injection, then rose at 30 min above the basal level. Injection of the drug at high concentrations inhibited respiration of brain, liver, and diaphragm, but when given in vivo at a dose of 25 mg/kg, respiration in these tissues was not affected. Injection of mice with doses above 7.5 mg/kg reduced body temperature for a 2-hr period; at the highest dose (50 mg/kg) the temperature fell 5°C. This drug when given to irradiated mice reduces the mortality rate from 100% to 25 to 50%, and in this respect it resembles other drugs which produce hypothermia and slow respiration. This was demonstrated when the mice were injected with 8.75 mg/kg 15 min before irradiation with 800 r at a dose rate of 40 r/min. The radioprotective effects of the compound are attributed to both its ability to lower body temperature and diminish respiration rate. (H.H.D.)

27190 ON THOROTRAST INJURY WITH DEVELOPMENT OF A HEMANGIOENDOTHELIAL SARCOMA OF LIVER. L. Schreiner (Krankenhaus Fürth i. B., Munich). Z. Krebsforsch., 64: 169-75(1961).

A review is presented on the tumorogenic action of thorotrast and a new case is presented. A male patient had been subjected in 1933 to a dozen or so thorotrast injections over a 2-week period in examinations for a kidney stone. In 1948 he developed cirrhosis, with clinical evidence of extensive ThO_2 deposits, and died 6 yr later of gastrointestinal bleeding. Antemortem radiographs of the liver showed marked opacity owing to accumulation of the contrast medium, and postmortem radioautographs of liver, spleen, and lymph nodes showed considerable radioactivity in reticuloendothelial cells. Liver parenchyma was largely replaced by fibrous tissue containing massive ThO_2 deposits, which showed a tendency toward calcification. Kupffer cells of the liver were also filled with ThO_2. A metastasizing cavernous hemangioma was present in the liver. The spleen, which was markedly enlarged and lacking follicles, showed higher levels of radioactivity than the liver. ThO_2 was also present in bone marrow, where fatty and fibrous replacement, with concomitant depression of erythropoiesis, were evident. The observed premalignant adenomatous hyperplasia of liver as well as the malignant hemangioma were attributed to thorotrast deposition in the liver. (H.H.D.)

27191 RADIONECROSIS OF THE PITUITARY BY THE ACTION OF YTTRIUM-90. J. Koevi (University Medical School, Budapest). Zentr. Allgem. Pathol. Pathol. Anat., 104: 139-44(Feb. 12, 1963).

Histopathologic findings are described in a pituitary which had been irradiated by Y^{90} implantation for the treatment of an inoperable mammary carcinoma. Two months before death of the patient, 4 mC Y^{90} had been implanted in the sella in an attempt to abolish pituitary endocrine secretion. Histologic examination of the gland showed that 90 to 95% of the adenohypophysis had been destroyed, leaving an encapsulated mass of fibrous tissue. Four zones in the irradiated gland could be discerned which were characterized by necrosis, necrobiosis, repair, and normality, respectively. In the necrotic zone, closest to the radiation source, almost complete destruction of glandular cells had occurred and only cellular debris was present. In the next most distant zone, most of the cells had been destroyed, but some cells remained, with pyknotic, shrunken nuclei and sparse, granule-free cytoplasm. Some neutrophil leukocytes were present in this zone as well as capillaries with intact endothelial cells. At the edge of this zone, in the 3rd zone, signs of repair were evident, including proliferation of fibroblasts and newly formed capillaries. Remaining glandular cells were surrounded by connective tissue. In the 4th peripheral zone normal-appearing cells were present, and the connective tissue capsule of the gland was markedly thickened. The results show that a high degree of pituitary inactivation can be obtained by Y^{90} implantation. (H.H.D.)

27192 IONIZIRUYUSHCHEE IZLUCHENIE I OBMEN VESHCHESTV. (Ionizing Radiation and Metabolism). L. S. Cherkasova, K. V. Fomichenko, T. M. Mironova, F. D. Koldobskaya, V. A. Kukushkina, and V. G. Remberger. Minsk, BSSR, Publishing House of the Academy of Sciences, 1962. 174p.

The results of recent investigations in the field of bio-

chemistry are summarized. The problem of changes and disturbances in metabolic processes in the central nervous system, the endocrine system, the gastrointestinal tract, and the liver and muscles after irradiation of the animal organism with ionizing radiation are presented. (C.E.S.)

27193 NEKOTORYE PROBLEMY DEISTVIYA IONIZIRUYUSHCHEI RADIATSII NA NERVNUYU SISTEMU. (Problems of Ionizing Radiation Effects on the Nervous System). M. N. Livanov. Moscow, State Publishing House of Medical Literature, 1962. 196p.

Basic mechanisms for the effects of ionizing radiation on the central nervous system are considered. Radiosensitivity of the eyes, head, body, and spinal column is discussed. Results from induced radiation sickness in animals are discussed. Primary reactions occurring near the radiation threshold and the large distribution of radiosensitivity in animals are reported. (C.E.S.)

27194 IRRADIATION AND THE NERVOUS SYSTEM. Charles D. Van Cleave (North Carolina. Univ., Chapel Hill. School of Medicine). New York, Rowman and Littlefield, Inc. 1963. 423p. $9.75.

Recent information is summarized on the effects of radiation on the nervous system. A comprehensive bibliography is included. (C.H.)

27195 PERVICHNYE PROTSESSY LUCHEVOGO PORAZHENIYA. (Fundamental Processes of Radiation Injuries). B. N. Tarusov. Moscow, Gosatomizdat, 1962. 96p.

Fundamental reactions and mechanisms that occur in biochemical substrata cells as a result of ionizing radiation effects are considered. Direct and indirect radiochemical processes and inhibiting reactions that take place are also investigated. Secondary reactions and radiosensitivity are also discussed. (C.E.S.)

27196 PROBLEMY KOSMICHESKOI BIOLOGII. TOM II. (Problems in Cosmic Biology. Volume II). N. M. Sisakyan and V. I. Yazdovskii, eds. Moscow, Publishing House of the Academy of Sciences, USSR, 1962. 430p.

Forty-two articles are included on developments in space biology and medicine. Effects of cosmic radiation on living cells during flights in satellite vehicles were analyzed, and results of laboratory studies of the effects of cosmic flights on man, animals, plants, and infusoria are discussed. Separate abstracts have been prepared for five articles of particular interest. Six other articles were previously abstracted in NSA. (R.V.J.)

27197 BIOLOGICAL EFFECTS OF COSMIC RADIATION IN SATELLITE VEHICLE. A. A. Gyurdzhian. p.93-7 of "Problemy Kosmicheskoi Biologii. Tom II." Moscow, Publishing House of the Academy of Sciences, USSR, 1962.

Experiments on space ships made possible investigations on the organic world at different developmental stages. The absorbed radiation dose inside the ship was about 10 mrad a day. No artificially induced radioactivity was found. Medical examination of dogs, rats, mice, and guinea-pigs immediately after the flight and later revealed no peculiarities in their general state, behavior, and physiological functions. Biochemical and immunological methods of investigation showed the transitory stress reaction. Microbiological and cytological objects that made a cosmic flight, the alga Chlorella included, did not differ from the control ones either. Genetic and cytological methods of investigation revealed a certain increase in the frequency of chromosomal aberrations distinguished by some peculiarities. Alongside, some biological objects displayed stimulated growth and cell division. Laboratory tests showed that the action of vibrations caused changes similar to those occurring during a space flight. (P.C.H.)

27198 EFFECTS OF COSMIC FLIGHT IN A SATELLITE VEHICLE ON CYTOLOGICAL AND HYSTOLOGICAL CHANGES IN HEMATOPOIETIC ORGANS OF MICE. M. A. Arcen'eva, V. V. Antipov, V. G. Petrukhin, et al. p.116-27 of "Problemy Kosmicheskoi Biologii. Tom II." Moscow, Publishing House of the Academy of Sciences, USSR, 1962.

The results of investigations on the effects of space flight on hematopoietic organs give evidence of some alterations in bone marrow and spleen of mice; the alterations registered two days after the flight began. Such alterations as chromosome sticking were found as a result of the differential effect of vibration and weightlessness. Moreover it was also found that acceleration and weightlessness are likely to cause disturbances in the spindle apparatus. It was concluded that the problem of the effects of cosmic flight on the cell is a very difficult one as a whole. (P.C.H.)

27199 EFFECTS OF COSMIC FLIGHT FACTORS IN SATELLITE VEHICLE "VOSTOK-2" ON HAPLOID AND DIPLOID YEAST ORGANISMS. N. V. Kovyazin, A. A. Lukin, and G. P. Parfenov. p.149-52 of "Problemy Kosmicheskoi Biologii. Tom II." Moscow, Publishing House of the Academy of Sciences, USSR, 1962.

Haploid and diploid yeast organisms placed in aqueous media and sensitized with oleic acid were exposed to the action of 25-hr cosmic flight factors. The effect of the influence was estimated by the survival of the cells. The space flight affected neither haploid nor diploid yeasts in aquatic medium. The survival of haploid cells in oleic acid medium drastically decreased (it fell by 50% at low concentrations of oleic acid). No influence of sensibilization was observed in diploid yeasts. (auth)

27200 EFFECTS OF COSMIC FLIGHT FACTORS ON CERTAIN BIOLOGICAL INDICES IN INSECTS. Ya. L. Glemobitskii and G. P. Parfenov. p.98-114 of "Problemy Kosmicheskoi Biologii. Tom II." Moscow, Publishing House of the Academy of Sciences, USSR, 1962.

Five satellite flights were utilized for testing the mutagenic effect of cosmic flight conditions on Drosophila melanogaster. Four tests were aimed at defining the induced frequency of: the primary non-disjunction of x-chromosomes; crossingover in males; dominant lethals; and sex-linked recessive lethals. There were 34 variants of experiments in the 4 tests. In 13 a significant increase of mutation frequency was found. Hereditary alterations were received, connected with the non-disjunction of chromosomes at meiosis, with chromosome reorganization (dominant lethals and crossingover in males) and point-mutations (recessive lethals). The origin of a wide spectrum of mutations even in cosmic flights of relatively short duration that did not reach the zones of high radioactivity, indicate theoretical and practical importance of detailed investigations of the influence of cosmic-flight factors on heredity. Experiments on the vibration chair indicate that mutations connected with chromosome reorganization may to a certain degree be conditioned by the rocket vibration. However, it seems to play an insignificant part in respect to point mutation. (P.C.H.)

27201 EXPERIMENTAL STUDIES OF COSMIC RADIATION EFFECTS ON HIGHER PLANTS. Yu. L. Sokolov and A. V. Gurskii. p.164-9 of "Problemy Kosmicheskoi Biologii. Tom II." Moscow, Publishing House of the Academy of Sciences, USSR, 1962.

Data are presented on spectral distribution of intensity

of solar radiation at different heights above sea level in the Pamir area. The data were obtained by means of a quartz spectrometer. The qualitative peculiarity of the Pamir radiation regime at heights about 2500–4500 m is the presence of rather powerful ultraviolet rays in the region of 295–315 mμ. The rays have a significant biological and physiological effectiveness. It was revealed that the intensivity of longwave (visible) part of spectrum is similar to the one at the border of the atmosphere. It permits imitation of the space radiation regime in Pamir conditions by adding ultraviolet rays of tubes to natural radiation. It is shown that plants adapt themselves rather well to such an artificial light regime. This was explained by means of photoreactivation influence that paralyzes the harmful effect of hard ultraviolet (~250 mμ) emitted by quartz lamps. (P.C.H.)

Radiation Sickness

27202 HEMATOLOGICAL CHANGES IN RADIATION SICKNESS. IV. CHANGES IN HEMOCOAGULATION. Z. Dienstbier, M. Arient, and J. Pospisil (Charles Univ., Prague). Atompraxis, 9: 189-94(May 1963). (In German)

Experiences in studying hemocoagulation changes in irradiated patients and persons occupationally exposed to ionizing radiation, as well as in animals after total-body radiation, are described. Whereas a progressive decrease in the platelet count in irradiated patients was observed in relation to radiation dose and time, it was found that in the occupational exposure group there was most frequently a disturbance in the prothrombin consumption test, usually in those cases where there was no thrombopenia. In animals, a disturbance developed in the thromboplastin-formation test after total-body irradiation. Normalization of the TGT was brought about by replacing the platelets of an irradiated animal with those from an unirradiated animal. It is believed that ionizing radiation interferes mainly with the first coagulation phase. This view is supported by an interpretation of the literature. Disturbance of platelet function occurs particularly in radiation sickness, whereas in the chronic form of radiation injury other contributing factors may be involved in the formation of active thromboplastin. (auth)

27203 ACUTE RADIATION NEPHRITIS. John N. Baldwin (Univ. of California, San Francisco) and Jack W. C. Hagstrom. Calif. Med., 97: 359-62(Dec. 1962).

Acute nephritis resulting from x-ray therapy of a nonresectable abdominal lymphosarcoma in a 63-yr-old man is reported. The estimated dose to each kidney was 3960 r, given over a period of 39 days. Symptoms of renal failure appeared 7 months later. The clinical features included hypertension, albuminuria, anemia, azotemia, congestive heart failure, and edema. These symptoms stem from a failure of 3 interrelated systems: renal, hematopoietic, and cardiac. Deterioration of kidney function probably occurs first, with consequent loss of concentrating power, nitrogen retention, and albuminuria. Oliguria is a terminal event, and death usually occurs within 3 or 4 months of the appearance of symptoms. The anemia of acute radiation nephritis is severe, rapid, refractory, and normocytic-normochromic. The marrow is not aplastic. Cardiac failure is often the presenting symptoms of acute radiation nephritis. Hypertension is striking and is assumed to be secondary to renal damage. Four structures are severely affected by renal irradiation: interstitium, glomeruli, tubules, and arterioles. Most consistently there is fibrosis of the interstitium, and, in time, contraction of the scar tissue leads to interference with glomerular and tubular blood supply. The glomeruli may be atrophied, have endothelial proliferation, or show partial or complete fibrosis. Tubules may undergo necrosis and atrophy. Arteriolar walls are often thickened and many show intimal endothelial proliferation. Care of the patient in any of the phases of nephritis can only be supportive and symptomatic, as there is no evidence to indicate that the lesions will regress. In the case reported, a brief trial of corticosteroids had no effect. (H.H.D.)

27204 PENETRATION OF SERRATIA MARCESCENS FROM THE INTESTINE INTO THE ORGANISM OF IRRADIATED DOGS. I. Kunstyr and J. Pospisil (Veterinary Research Unit, Prague). Folia Microbiol. (Prague), 7: 83-7(Jan. 1962).

The role of bacterial infection in the fatal course of the radiation syndrome was investigated. Dogs were given a whole-body dose of 600-r x rays, and egress of bacteria from the intestine into the lymph was investigated. The presence of the test organism Serratia marcescens in the mesenteric lymph nodes, central lymph, peripheral blood, some organs, and the large intestine was investigated. Serratia could be found in mesenteric lymph nodes examined 24 hr and 5 days after irradiation. In the groups examined 8 and 15 days after irradiation bacteria were also present. The lymph was positive in half of the 8-day group and in ⅓ of the 15-day group. The controls and first 2 experimental groups were negative. The finding in the blood was similar to that in the lymph. Findings of bacteria in lymph removed from the thoracic duct in the 8-day group were twice as frequent as in the blood of the same period. The relatively low number of positive cultures from the intestine can be explained by unphysiological conditions existing there for any but the obligatory intestinal microorganisms. (TCO)

27205 STUDIES OF THE INTESTINE DURING ACUTE RADIATION SYNDROME. D. G. Baker and R. I. Mitchell (Univ. of Toronto and Wellesley Hospital, Toronto). Gastroenterology, 44: 291-300(Mar. 1963).

The effects of irradiation on the intestinal tract of rats were studied. Enzyme studies with particular reference to esterase and alkaline phosphatase correlated with histologic studies of the injury process revealed a segmental radiosensitivity of the gut most marked in proximal segments and diminishing caudally. Variation in dose affects the rate of recovery rather than initial damage and there are only slight differences in the response to whole-body and abdominal irradiation. Electrolyte studies failed to show these segmental variations except that the large bowel generally was much slower to recover. Potassium content seemed directly related to cellular damage of the intestinal mucosa, whereas sodium and water content seemed to be controlled by a number of general body factors manifesting themselves in a different response to whole body rather than to abdominal irradiation. (auth)

27206 GENETIC FACTORS INFLUENCING IRRADIATION PROTECTION BY BONE MARROW. III. MIDLETHAL IRRADIATION OF INBRED MICE. Delta E. Uphoff (National Cancer Inst., Bethesda, Md.). J. Natl. Cancer Inst., 30: 1115-41(June 1963).

Results from inoculation of allogeneic marrow after midlethal irradiation in various donor-host combinations of inbred strains and F_1 hybrids can be classified as an early lethal effect; no beneficial or deleterious effect; initial protection followed by late deaths; or lasting protection. These results depend on the strain combinations used. The early lethal effect in certain host-donor combinations was

altered by delayed marrow inoculation, use of substrain C3HeB as the irradiated host, and preimmunization of the irradiated host. Certain host-donor combinations without early mortality presented evidence of reversal to host phenotype. This reversal was demonstrated by transplantation of reticuloendothelial tumors arising in the treated mice and by transplantation of strain-specific transplantable neoplasms. (auth)

27207 GENETIC FACTORS INFLUENCING IRRADIATION PROTECTION BY BONE MARROW. IV. MIDLETHAL IRRADIATION OF F_1 HYBRID MICE. Delta E. Uphoff (National Cancer Inst., Bethesda, Md.). J. Natl. Cancer Inst., 30: 1143-51(June 1963).

Results from inoculation of allogeneic marrow after midlethal irradiation of various F_1 hybrid mice follow essentially the same pattern as those for inbred strains. Early mortality occurs only in mice in which one of the parental strains of the hybrid is C3Hf or CBA. (auth)

27208 EARLY DIAGNOSIS AND TREATMENT OF INDIVIDUALS WHO HAVE EXCESSIVE DEPOSITIONS OF RADIOISOTOPES. W. D. Norwood (General Electric Co., Richland, Wash.). J. Occupational Med., 4: 373-82(July 1962).

Various aspects of human exposure to radioisotopes are discussed including early diagnosis and treatment, mode of entry (ingestion, inhalation, absorption), and deposition and elimination of absorbed radionuclides. Many factors influence the deposition, clearance, translocation, and excretion of inhaled particles, but the influence of solubility and particle size are of special importance. A lung model is described that may be helpful in making an intelligent guess to determine necessity for treatment when specific data are not available. Measurements of radiation emanating from the body and of the radioactive material in urine, feces, blood, exhaled air, and biopsy material may be of great help in estimating the amount and identity of deposited radioisotopes. Maximum permissible body burdens of the most dangerous radioisotopes are discussed. General and specific methods are outlined for treating individuals who have deposits of radioactive material on skin, in wounds, in the lungs, and in the body. DTPA (diethylenetriaminepentaacetic acid) is the most valuable agent presently available for increasing the rate of the urinary elimination of Pu and some of the other transuranic elements, as well as U and many of the fission products. Intravenous administration of DTPA was shown to increase the rate of elimination of Pu^{239} via the urine in 5 cases by factors ranging from 45 to 120. However, the smallest possible effective dose of DTPA should be used because of its potential toxic effect on the kidneys. (TCO)

27209 THE INFLUENCE OF METABOLIC FACTORS ON RADIOSENSITIVITY. Roger Ghys (Laval Univ., Quebec). Laval Med., 34: 69-79(Jan. 1963). (In French)

From Symposium on Radiosensitivity, Laval Univ., Quebec, Sept. 1962.

In rats injected intramuscularly with 25 mg/100 g testosterone propionate 8 hr before irradiation, the hormone had a radiosensitizing effect in males but not in females, on the basis of increased mortality rate. This was observed with radiation from fast (2-Mev) neutrons and the β emitter P^{32}, and with the radiomimetic drug Myleran. Diarrhea and anemia were accentuated by testosterone in the male rats, whereas it ameliorated the effects in female rats. The anabolic steroid methandrosthenolone (Danabol) also sensitized male rats to γ radiation from Co^{60}, and the effect was not modified by hypophysectomy or castration. Estradiol had a greater radiosensitizing effect than testosterone in male rats. Danabol, although increasing radiation injury to bone marrow cells, tended to attenuate the digestive symptoms, which were attributed to the improved electrolyte balance produced by this steroid in irradiated rats. Exposure of rats to cold (1°C), following irradiation, considerably accelerated their metabolic rate and aggravated the effects of radiation. However, rats acclimated to cold are more resistant to radiation, whether maintained in the cold or at room temperature following irradiation. Such cold-adapted rats were shown to have lower body weight, higher liver weight, and higher plasma protein levels than control rats. (H.H.D.)

27210 DISEASES OF MODERN CIVILIZATION. I. LEUKEMIA. Tadeusz Giza (Academy of Medicine, Krakow). Przeglad Lekar., (2) 19: 175-7(Mar. 24, 1963).

Sources of radiation (natural and fall-out) are listed and graded. Immediate and long-range physiological and genetic effects and natural defense of body as revealed and witnessed by the fact that leukemia occurs primarily in children and aged are discussed. Using leukemia as an example, seven factors linking fall out radiation with leukemia incidence are cited, and specific data on the rise of the disease in Poland as a whole, and in several particular localities are quoted. (TCO)

27211 ACUTE RADIATION INJURY IN THE ALIMENTARY TRACT: A REVIEW. D. G. Baker (Univ. of Toronto). D. G. Baker (Univ. of Toronto). Rev. Can. Biol., 22: No. 1, 91-7(Mar. 1963). (In English)

Results are reviewed from recent studies on acute radiation injury in the alimentary tract. Data are included on radioinduced pathological changes in oral tissues, the stomach, and intestine. It is pointed out that radioinduced responses of the alimentary tract are primarily associated with injuries to the lining membrane. Evidence of the development of radioresistance following a single small acute or fractional dose of x rays is discussed. (C.H.)

27212 FIBRINOLYTIC ACTIVITY IN THE RADIATION SYNDROME IN DOGS. M. Kopec, Z. Wegrzynowicz, S. Lopaciuk, and J. Beer (Hematology Inst., Warsaw). Thromb. Diath. Haemorrhag., 5: 583-94(Apr. 1, 1961). (In German)

Ten dogs were submitted to whole-body x irradiation with 600 r at a dose rate of 7 r/min. All dogs died with symptoms of the acute radiation syndrome within 2 weeks. The Lee-White coagulation time began to be prolonged from the 5th to 7th day after irradiation and reached 3- to 6-fold the initial values. An insignificant prolongation of the recalcification time occurred only in the last days before death of the animals, and thrombin time did not change significantly. Fibrinogen level increased up to 3-fold the initial value, and fibrinolysis time in euglobulins was prolonged. The proteolytic activity of the euglobulins, estimated with I^{131}-labeled fibrinogen, was decreased. It was shown that the decrease of fibrinolytic and proteolytic activity of the euglobulins was due to an increase of the antiplasmin level. The level of proactivator and plasminogen did not change. It was concluded that the hemorrhagic diathesis accompanying fatal radiation disease in dogs is accompanied by an inhibition rather than an increase in fibrinolysis, and that this results from a rise in serum antiplasmin activity. (TCO)

CHEMISTRY

General and Miscellaneous

27213 SAFE, SIMPLE METHOD OF OPENING IRRADIATED SILICA AMPOULES. Ray Porritt and Malcolm Thackray (Australian Atomic Energy Commission, Research Establishment, Lucas Heights, New South Wales). Anal. Chem., 35: 1111(July 1963).

A method was developed for opening silica ampoules containing irradiated semisolid biological samples prior to perchloric acid oxidation. The method comprises crushing the ampoule in a vertical piece of flexible plastic tube over a beaker and rinsing the ampoule out with acetone or other solvent. (D.L.C.)

27214 CHELATE FORMATION BETWEEN THORIUM (IV) AND SULFODICHLOROHYDROXYDIMETHYLFUCHSON DICARBOXYLIC ACID (TRISODIUM SALT). STUDIES ON THE COMPOSITION AND STABILITY OF THE CHELATE AND ANALYTICAL APPLICATIONS OF THE REACTION. Suresh C. Srivastava, Surendra Nath Sinha, and Arun K. Dey (Univ. of Allahabad, India). Bull. Chem. Soc. Japan, 36: 268-77(Mar. 1963). (In English)

An investigation was conducted of the thorium(IV) chelate with Chrome Azurol S. Chrome Azurol S was found to behave as a colloidal eletrolyte. Only one chelate with thorium(IV) is formed with maximum absorbance at 550 mμ, and its stoichiometry is 1:1. The logarithm of the stability constant of the complex is ~4.5. The effects of pH and various ions on the reaction are described. The sensitivity of the reaction is 0.047 γ/cm^2. A brief procedure for the colorimetric determination of Th is suggested. (D.L.C.)

27215 STUDY ON THE REACTION BETWEEN POLYMER RADICAL AND 1,1-DIPHENYL-2-PICRYL HYDRAZYL. Hiroshi Yoshida, Kozo Tsuji, Koichiro Hayashi, and Seizo Okamura (Kyoto Univ.). Bull. Inst. Chem. Res., Kyoto Univ., 41: 39-47(Mar. 1963). (In English)

1,1-Diphenyl-2-picryl hydrazyl (DPPH) has been used as a radical scavenger for various reactions both in solution and in solid. In the present study, reactions between DPPH dispersed in polymethylmethacrylate film and radicals produced by irradiation of DPPH-polymer system and the effect of oxygen on the reactions are investigated using electron spin resonance spectroscopy. The results are as follows: the rate of decomposition of DPPH by irradiation is the same both in vacuo and in the presence of air at a higher initial concentration of DPPH. At a lower initial concentration of DPPH, on the other hand, the decomposition is accelerated in the presence of air. This is due to the fact that the rate constant of the reaction of peroxy radical ($PO_2\cdot$) with DPPH is larger than that of the initial polymer radical ($P\cdot$). (auth)

27216 GENERAL LABELLING OF WOOL WITH I^{131}. H. E. Dobbs (Wantage Research Lab., Berks, Eng.). Intern. J. Appl. Radiation Isotopes, 14: 238-9(June 1963). (In English)

A method for labeling wool fibers with I^{131} was developed for following the passage of individual staples through textile manufacturing processes. The method comprises immersing the staples first in bromine water and then in a carrier-free solution of I^{131}. The effects of time of exposure to the bromine and I^{131} solutions were investigated. For single 10-cm long wool staples, immersion times of 5 min each in 0.1 M bromine water and in 0.1 ml of a solution containing 1 mC of I^{131} resulted in ~10 μC being fixed to the staple. (D.L.C.)

27217 YTTRIUM AND RARE EARTH VANADATES. J. R. Gambino and C. J. Guare (General Electric Co., Schenectady, N. Y.). Nature, 198: 1084-5(June 15, 1963).

The vanadates of rare earths from Pr to Er were prepared by heating equimolar powder mixtures of rare earth oxides and V_2O_5 at 950°C. The compounds all had the same structure as YVO_4. Diffraction patterns for the compounds are presented. They were obtained using a General Electric XRD-3 unit with a goniometer and Ni filtered Cu radiation. (C.H.)

27218 ADSORPTION OF RADIOACTIVE IONS BY THE CALCINED MONTMORILLONITE. Mutsumi Nishidoi (Kurita Central Labs., [Japan]). Nippon Genshiryoku Gakkaishi, 5: 377-81(May 1963). (In Japanese)

Although montmorillonite has a high cation exchange capacity, it has undesirable characteristics such as swelling and disintegrating into very fine particles in water, which causes difficulty in separation from aqueous phase. To improve these faults, a new stable exchanger was prepared by the calcination of granular montmorillonite. The decrease of ion exchange capacity due to the calcination was improved by the treatment with hydrochloric acid or sodium hydroxide. It was found that the Na-form exchanger treated with sodium hydroxide was excellent in the exchange capacity and the decontamination factor for radioactive ions. A linear relationship was found between the concentration of coexisting Na ion and the adsorbed equilibrium of Cs^{137} on the montmorillonite, and also between breakthrough ratio of radioactive ion and the effluent volume in the range of rather low breakthrough ratio. It is possible to adopt this new product for the decontamination of radioactive ion in water by the column operation process. (auth)

27219 EXISTENCE OF TRIBUTYL PHOSPHATE MONOHYDRATE. Robert C. Axtmann (Princeton Univ., N. J.). Nucl. Sci. Eng., 16: 240-2(June 1963).

A criticism is presented of Olander and Benedict's conclusion that $TBP\cdot H_2O$ does not exist, from mass transfer rate comparisons between $TBP-H_2O$ and other solvent$-H_2O$ systems (ibid., 14: 287). The evidence for the existence of $TBP\cdot H_2O$ is described in some detail. A reply from Olander is included. (D.L.C.)

27220 METHOD OF PRODUCING ELEMENTS FROM THEIR HALIDES. (to Elektrophysikalische Anstalt Bernhard Berghaus). British Patent 928,853. June 19, 1963. Priority date July 14, 1958, Switzerland.

A method is given for obtaining, from their halides, metals of which the halides are capable of forming addition compounds with NH_3, i.e., the light metals, transition metals, and the elements B, Si, Ge, and Sn. The method comprises forming the addition compound by reaction with NH_3 jets and obtaining the metal by subjecting the addition compound to ionized N_2-H_2 jets. The method and two embodiments of a plant for carrying out the method are described using the preparation of Ti from $TiCl_4$ as an example. (D.L.C.)

27221 POLYMERIC TIN ALUMINIUM COMPOUNDS AND PROCESS OF MAKING SAME. (to Hughes Aircraft Co.). British Patent 929,246. June 19, 1963. Priority data June 27, 1960, United States.

A process is given for producing the following polymeric compounds which have outstanding thermal stability: triorganostannoxy aluminoxane or triorganostannoxy stannoaluminoxane polymer, where organo = alkyl, aryl, aralkyl, or alkaryl. The process comprises reacting a triorganostannoxy alkoxy, aryloxy, aralkoxy, or alkaryloxy aluminum with water, a carboxylic acid anhydride, triorganostannoxy diacyloxy aluminum, or a diorgano diacyloxy tin. The resulting polymers may be used in the fabrication of components for missiles, rockets, etc. (D.L.C.)

27222 IMPROVEMENTS IN OR RELATING TO TESTING FOR THE PRESENCE OF A COMPONENT IN LIQUORS. John Winfrith de Lisle Nichols and Colin Ramsay McGowan (to United Kingdom Atomic Energy Authority). British Patent 929,580. June 26, 1963. Filed Aug. 2, 1960.

An apparatus is designed for testing for the presence of nitrite in plutonium liquors from which plutonium salts are to be prepared. In the operation of the apparatus, a small, fixed amount of liquor is withdrawn and mixed with a continuously flowing test reagent (starch-iodide) in a chamber. The length of the interval between withdrawals of liquor is controlled by the intensity of the colorimetric reaction between the test reagent and the last liquor withdrawal in such a way that the more intense the reaction, the longer the interval. An absence or excess of nitrite in the liquor actuates an alarm. (D.L.C.)

27223 LIQUID FOOD TREATING PROCESS. Leon Singer and Wallace D. Armstrong (to Regents of the Univ. of Minnesota). U. S. Patent 3,094,419. June 18, 1963. Filed Dec. 21, 1959.

A method is given for reducing the concentration of radiostrontium in milk. The method comprises intimately contacting the milk with a solid, finely divided calcium mineral to effect heteroionic exchange. Examples of minerals which may be used are anorganic bone, protein-free bone, apatites, crandallite, calcium phosphates, and calcium sulfate. A large number of examples of the application of the method are given. (D.L.C.)

Analytical Procedures

27224 (AERE-AM-68) THE DETERMINATION OF RADIORUTHENIUM. J. W. Arden, G. J. Hunter, and M. Perkins (United Kingdom Atomic Energy Authority. Research Group. Chemistry Div., Woolwich Outstation, England). Apr. 1963. 17p.

Exchange was established between radioruthenium and ruthenium carrier in a hot solution to which potassium periodate and potassium persulfate had been added. After cooling and acidifying the solution, Ru was extracted from it into carbon tetrachloride. The Ru was recovered from the organic phase by precipitating a lower oxide with methanol. The precipitate was dissolved in dilute acid and by adding Mg powder Ru metal was precipitated, and then counted; the chemical yield was determined by weighing. Alternatively, the lower oxide was precipitated in the presence of borax and the mixed solids were mounted and counted; the chemical yield was determined absorptiometrically after dissolving the source. (auth)

27225 (AERE-R-4295) SURFACE IONIZATION TECHNIQUES IN MASS SPECTROMETRY. A. H. Turnbull (United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England). Mar. 1963. 26p.

The theory and practice of surface ionization mass spectrometry are discussed, the latter with particular reference to the A.E.I. Type MS5 mass spectrometer. Conditions are described under which positive ions of various elements or compounds are produced in the course of isotopic analyses. (auth)

27226 (EUR-21.f) LE DOSAGE DES IMPURETES DANS LE SAP PAR SPECTROGRAPHIE DES RAYONS X. (The Determination of Impurities in SAP by X-Ray Spectrography). G. Vos and C. Toussaint (European Atomic Energy Community. Nuclear Research Center, Ispra, Italy). Aug. 1962. 17p.

The use of spectrographic standards of aluminum permits the rapid and nondestructive determination of Fe, Ni, Cu, Zn, Ga, V, Ti, Cr, and Mn in SAP with a detection sensitivity varying from 1 to 20 ppm, for a counting time of 64 seconds. Four samples with an amount of Al_2O_3 between 4 and 14% were analyzed. There seems to be satisfactory agreement with the analyses given by the suppliers, although the amount of impurities increases with the Al_2O_3 concentration. (auth)

27227 (EUR-28.f) LE DOSAGE DES TRACES DE Fe, Ni ET Cr DANS LES POLYPHENYLES PAR SPECTROGRAPHIE X. (Determination of Fe, Ni and Cr Traces in Polyphenyls by X-Ray Spectrography). G. Vos and W. De Spiegeleer (European Atomic Energy Community. Nuclear Research Center, Ispra, Italy). Aug. 1962. 20p.

The presence of steel corrosion products in polyphenyls has lead to the development of a method for the dosage of Fe, Ni, and Cr traces by X-ray spectrography which enables detection to be carried out from 0.5 to 1 ppm, the concentration range being from 0 to 1000 ppm for iron and from 0 to 500 ppm for chromium and nickel. Analysis is made by comparison with synthetic standards. The method is fast (10 minutes per dosage), direct, and non-destructive. The interferences due to the matrix and other elements are negligible. (auth)

27228 (EUR-32.f) LE DOSAGE SEMI-QUANTITATIF DE Ba, Nb, Sr, Fe, Mn ET Zn DANS LES CARBONATITES PAR SPECTROGRAPHIE DES RAYONS X. (Semi-Quantitative Determination of Ba, Nb, Sr, Fe, Mn and Zn in the Carbonatites by X Ray Spectrography). G. Vos and W. De Spiegeleer (European Atomic Energy Community. Nuclear Research Center, Ispra, Italy). 1962. 18p.

The spectrographical method allows the rapid and semi-quantitative determination of Nb, Sr, and Ba in carbonatites. Elements of the iron group are determined by comparison with the diffusion line L α 1 of the anticathode of W, used as internal standard. The method allows the determination of concentrations in the range from 0.01 to some % with a relative precision of 30% and in matrices of very different compositions. (auth)

27229 (EUR-248.f) POSSIBILITÉ D'ANALYSE NON DESTRUCTIVE DE MATÉRIAUX COMBUSTIBLES À BASE D'^{235}U. (Possibility of Nondestructive Analysis of Fuel Elements Containing U^{235}). P. Guillot and P. Varekamp (European Atomic Energy Community. Nuclear Research Center, Ispra, Italy). 1963. 32p.

An existing method for the measurement of the uranium enrichment is improved to allow for the nondestructive analysis of natural uranium carbides or oxides. It is possible to measure the U^{235} amount, of the order of 10 grams, in fuel elements within an error of 0.5% so that the indirect determination of the carbon or oxygen is made within an error of 10 or 3%, respectively. (auth)

27230 (IA-839) ACTIVATION ANALYSIS WITH A NUCLEAR REACTOR, NOT BASED ON (n,γ) REACTIONS.

S. Amiel (Israel. Atomic Energy Commission, Rehovoth). Apr. 1963. 35p.

A review is given of activation analysis techniques based on nuclear reactions, other than (n,γ) reactions, performed with the aid of a reactor or reactor-produced sources. Possible future developments are mentioned. 75 references. (auth)

27231 (IDO-14605) ANNUAL REPORT OF DIVISION ANALYTICAL BRANCH FOR 1962. Ralph C. Shank, et al. (Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho). Apr. 25, 1963. Contract AT(10-1)-205. 181p.

Information on developments in equipment and processes and on the 71,378 determinations performed is included. The information is presented in chapters devoted to the work of the chemical analysis section, radio and special analysis section, spectroscopy section, analytical development section, quality control and standards laboratory, and analytical service for EOCR. Details of methods added to the ICPP analytical manual and to the ICPP analytical radiochemical manual are included. (D.C.W.)

27232 (LA-2892) THE TITRIMETRIC DETERMINATION OF TRACES OF NITRIDE NITROGEN IN SODIUM METAL. C. H. Ward, R. D. Gardner, W. H. Ashley, and A. Zerwekh (Los Alamos Scientific Lab., N. Mex.). Apr. 1963. Contract W-7405-eng-36. 11p.

A modified Kjeldahl method has been shown to be applicable to the determination of nitride N in Na metal. The Na is dissolved in ethanol in an Ar atmosphere. The solution is diluted with water and the N distilled out as ammonia. The ammonia is absorbed in a dilute boric acid solution and titrated with 0.01N hydrochloric acid to the endpoint of a mixed methyl red-bromcresol green indicator. The average recovery for 31 samples containing known amounts of N in the 1 to 100 ppm range was 100.0%. The average standard deviation over the entire range was 2.5% relative. This number increases rapidly in the lower part of the range. In absolute terms, it was less than 1 ppm over the whole range. (auth)

27233 (ORO-588) DOUBLE DECOMPOSITION RADIO RELEASE ANALYSIS FOR CALCIUM AND PHOSPHATE IONS. Final Report. Harold G. Richter and A. S. Gillespie, Jr. (Research Triangle Inst., Durham, N. C. Isotope Development Lab.). Dec. 31, 1962. Contract AT(40-1)-2513. 25p.

A rapid procedure for analysis of calcium and phosphate ions in fertilizer samples using the double-decomposition radio-release technique proved unsuccessful. The radio-release system is based on a difference in solubility of two compounds. A solution containing the radio-inactive ion of interest is passed through a column of some material, perhaps an ion exchanger, containing a radioisotope. A chemical reaction takes place whereby the inactive ion is retained on the column and the radioactive species is released. This latter species is subsequently detected and the counting rate is directly related to the concentration of the influent ion of interest. While several of the columns exhibited satisfactory behavior when used with calcium alone and at a certain pH, the presence of other divalent ions or a lower pH of the solution released the radioactive ion from the column and thereby obscured the calcium-influenced release. The same results were obtained with phosphate ions. The principle of radio-release was successfully applied to the determination of aqueous dissolved oxygen by its action on thallium metal releasing thallous ions, and to the determination of vanadate ions for use as a radioactive surface water tracer by its action on a silver metal column releasing silver ion. (N.W.R.)

27234 (PG-Report-437) ANALYTICAL METHOD FOR THE ABSORPTIOMETRIC DETERMINATION OF IRON IN MAGNOX MN 70. (United Kingdom Atomic Energy Authority. Production Group, Springfields, Lancs, England). 1963. 5p.

The alloy is dissolved in hydrochloric acid. The Fe content is determined absorptiometrically as the thioglycollic acid complex. (J.R.D.)

27235 (PG-Report-444) ANALYTICAL METHOD FOR THE DETERMINATION OF TOTAL CARBON IN URANIUM CARBIDE BY COMBUSTION AND ABSORPTION OF CARBON DIOXIDE. (United Kingdom Atomic Energy Authority. Production Group, Springfields, Lancs, England). 1963. 6p.

An appropriate weight of uranium carbide is ignited in a current of argon and oxygen, then oxygen only at a temperature of 950 to 1050°C and the carbon dioxide produced is absorbed in soda asbestos and weighed. The precision, determined using 1.5 g portions of uranium monocarbide, yielded 95% confidence limits of ±0.03% for a single determination at a carbon content of 4.64 wt %. (auth)

27236 (PG-Report-453) ANALYTICAL METHOD FOR THE ABSORPTIOMETRIC DETERMINATION OF IRON IN MAGNOX AL 80 AND MAGNOX ZR 55 ALLOYS. (United Kingdom Atomic Energy Authority. Production Group, Springfields, Lancs, England). 1963. 5p.

Iron is determined absorptiometrically as the ferrous 1, 10-phenanthroline complex in a buffered solution of the alloy. The method is suitable for the determination of iron in the range 0 to 50 ppm. At the 20 ppm level the standard deviation is ±1.8 ppm. The method is considered to be free from bias. (auth)

27237 (PG-Report-454) ANALYTICAL METHOD FOR THE VOLUMETRIC DETERMINATION OF ALUMINIUM IN MAGNOX AL 80. (United Kingdom Atomic Energy Authority. Production Group, Springfields, Lancs, England). 1963. 5p.

The aluminum is complexed without previous separation in a hydrochloric acid solution of the alloy, using an excess of standard EDTA solution. Excess EDTA is determined by titration using standard zinc chloride solution with dithizone as indicator. The method is suitable for the determination of aluminum in the range 0.4 to 1.0%. Within the range 0.7 to 0.9% the standard deviation is ±0.01%. The method is considered to be free from bias. (auth)

27238 (PG-Report-463) ANALYTICAL METHOD FOR THE DETERMINATION OF THE RESIDUAL GAS IN GASEOUS CARBON DIOXIDE AFTER ABSORPTION WITH POTASSIUM HYDROXIDE. (FOR RESIDUAL GAS LEVELS BELOW 0.01%). (United Kingdom Atomic Energy Authority. Production Group, Windscale, Sellafield, England). 1963. 5p.

Potassium hydroxide solution is added to a known volume of carbon dioxide gas which was collected over mercury. After absorption of the carbon dioxide, the residual gas is measured in a graduated capillary. The method is suitable for the determination of the residual gas (0.001 to 0.050 vol %) in gaseous carbon dioxide from gasification of the liquid and gaseous carbon dioxide feed to reactors of the Calder type. When the concentration of residual gas exceeds 0.01% an alternative method using brine instead of mercury is preferred (e.g., PG-Report 457(W)) which is applicable up to 10%. (auth)

27239 (PG-Report-467) ANALYTICAL METHOD FOR THE DETERMINATION OF WATER IN TRIBUTYL PHOSPHATE (INFRA-RED ABSORPTION SPECTROMETRY). (United Kingdom Atomic Energy Authority. Production Group, Windscale, Sellafield, England). 1963. 5p.

The sample is examined directly, and the absorbance due to the H–O–H at 1630 cm^{-1} is measured and referred to a calibration curve. Because of the method of calibration the bias should be zero. At the 0.5% wt/vol level the precision (3 times the coefficient of variation) is ±4%. (auth)

27240 (TID-18883) INTERIM TECHNICAL REPORT [ON NUCLEAR TECHNIQUES IN COAL ANALYSIS], FOR PERIOD ENDING JANUARY 31, 1963. Troy C. Martin and Suresh C. Mathur (Texas Nuclear Corp., Austin, Tex.). Contract AT(40-1)-2980. 34p.

The results of a literature survey are given as well as the results of analytical studies of the feasibility of using nuclear techniques in coal analysis. The results of fast neutron activation analysis of coal and coal ash and the results of fast neutron inelastic scattering on coal samples are reported. The results are tabulated and compared with available data from chemical analysis. (auth)

27241 (TID-18908) ACTIVATION ANALYSIS AND THE RESEARCH REACTOR. W. Wayne Meinke (Michigan. Univ., Ann Arbor. Dept. of Chemistry). [Mar. 1963]. Contract AT(11-1)-1143. 28p.

The current status of activation analysis is discussed. Topics covered include: sensitivity, discrimination, nondestructive analysis, applicability for a research-reactor center, and solution of local problems by activation analysis. General examples of the method are given. (M.C.G.)

27242 (TID-18925) PRODUCTION OF X-RAY SPECTRA. Paul D. Zemany (Knolls Atomic Power Lab., Schenectady, N. Y.). [nd]. Contract W-31-109-eng-52. 29p.

Design and capabilities of the electron beam microprobe and the analytical x-ray spectrograph are discussed, and the characteristics and production of primary and secondary x-rays are described. Equipment used in x-ray generation is also examined. (D.C.W.)

27243 (AEC-tr-5822) THE DETERMINATION OF THE ALKALI METALS. M. L. Yashchenko, G. V. Ovchinnikova, and L. I. Afanas'eva. Translated for Ames Lab., Ames Iowa from Tr. 5-oi [Pyatoi] Sessii Komis. po Opred. Absolyut. Vozrasta Geol. Formatsii Akad. Nauk SSSR, Otd. Geol.-Geogr. Nauk, Moscow, 1958, 296-307([1960]). 13p.

Experiments on the effectiveness of the Stevens and Wells method for determining the alkali metal content of minerals and ores are described. Separation of K and Rb is based on the extraction of Rb and Cs chlorides by ethyl alcohol saturated with HCl, in which the solubility of KCl is very low. A radioactive tracer was used to eliminate the main disadvantage of the method (repeated K salting-out), to decrease the number of required extractions, and to control the yield of Rb. K^{42}, Rb^{86}, and Cs^{134} were used as tracers for solutions involving alkali chlorides and chloroplatinates. Data are given. (D.C.W.)

27244 (AEC-tr-5839) ANALYSIS OF TRACES OF CARBON IN SODIUM. J. Sannier and A. Vasseur (France. Commissariat a l'Energie Atomique. Centre d'Etudes Nucleaires, Saclay). Translated for Atomic Power Development Associates, Inc. from report DM-1203. 10p.

A method for the wet analysis of carbon in sodium was developed. The oxidation of carbon by the solution of Van Slyke is carried out under a vacuum; the carbon dioxide formed is analyzed volumetrically; its purity can be controlled by chromatographic analysis. The results obtained show that this method permits the analysis of carbon contents in the order of 10 ppm. (auth)

27245 (AEC-tr-5840) ANALYSIS OF OXYGEN IN SODIUM. THE MERCURY METHOD; ITS USE IN THE CASE OF VERY SMALL QUANTITIES. L. Champeix, R. Darras, and J. Duflo. Translated for Atomic Power Development Associates, Inc., Detroit from J. Nucl. Mater., 2: 113-19 (1959). 14p.

The extent to which the mercury method can be utilized in the range of small contents (below 20 ppm) with an acceptable accuracy was studied. It was concluded that the mercury method is valid even for very small oxide contents, provided that certain precautions are taken, particularly the use of spectrophotometric analysis for contents below 40 ppm. It is possible to analyze 7 ppm with a reproducibility of ±1.5 ppm, but the sensitivity of the analytical method and the examination of the various causes of error (titer of the method, and chlorides) would indicate that contents ranging between 1 and 7 ppm can be analyzed with an accuracy of the same order. Nevertheless, at these contents, the sampling of a sodium sample without contamination becomes a very delicate operation. (P.C.H.)

27246 EXPERIENCES ON ANALYZING ROCKS OF MINUTE THORIUM CONTENT AND RAPID DETERMINATION OF THORIUM ON USING ARSENAZO III. Endre Upor, István Jurcsik (Yurchik), and M. Mohai. Acta Chim. Acad. Sci. Hung., 37: 1-15(1963). (In Russian)

The suitability of certain reagents for analysis of rocks of minute thorium content was investigated. Of these, toron appeared to be unsuited for serial tests and SPADNS could only be used for analyzing pure thorium solution. Arsenazo II lends itself to use after an adequate separation. Arsenazo III without any previous separation is suitable in determining thorium in rocks of conventional composition. In rock samples which contain 1% of titanium or some hundredth per cent of uranium, a previous separation with tributyl phosphate in an oxalate or hydrochloric acid medium is necessary. The method can be reliably used in thorium contents of 0.001%. The preparation of the reagent is discussed. (auth)

27247 EFFECT OF STORAGE ON IODINE-131 SOLUTIONS. C. P. Lantos and J. H. Tramezzani (Instituto de Biologia y Medicina Experimental, Buenos Aires). Acta Physiol. Latinoam., 11: 1-3(1961). (In English)

A study was undertaken to investigate whether impurities appear in NaI^{131} used for clinical and biological research. Three batches of Amersham, carrier-free NaI^{131}, in dilute sodium thiosulfate were examined. In all chromatograms a sharp band with an rf equal to 0.3 was obtained, parallel to the one shown by NaI^{131} upon immersion in silver nitrate solution. The rf corresponds to iodide ion. In all batches, narrow single bands at the origin were also obtained, but the intensity of the bands was practically insignificant in relation to the intensity of I^{131} bands. To establish whether the band at the origin belonged to a pre-existing element of longer half life than I^{131} or to an element that appears during disintegration of I^{131}, a fresh solution of 4 μC was chromatographed. The band at the origin appeared in this sample, less than 1 week old. Wider bands of I^{131} (1.5 to 2 cm) than those previously obtained were observed. Photometric measurements of the bands showed, however, unimodal curves, which are similar in their pattern. The bands can thus be considered as single and homogeneous, in spite of their width, and not as 2 or more over-lapping bands. The

results show that radioiodine from Amersham, does not present the impurities previously found in samples. (TCO)

27248 A HIGH SENSITIVITY SCANNING COULOMETER WITH AUTOMATIC BACKGROUND CORRECTION AND PROPORTIONAL SCAN RATE. TITRATION OF PLUTONIUM AND OTHER REDOX SPECIES. R. C. Propst (E. I. du Pont de Nemours & Co., Aiken, S. C.). Anal. Chem., 35: 958-63(July 1963).

The scanning coulometer is a new electroanalytical instrument for recording coulomb-potential curves of reversible processes under nearly equilibrium conditions. The circuit features a novel system for producing a scan rate that is an inverse function of the electrolysis current. Compensator networks provide automatic corrections for the continuous faradaic current and the charging of the electrical double layer. Application of the instrument is described to the direct determination of plutonium in irradiated nuclear fuel at the 2- to 5-μg level with a precision of 2.1% (n = 10, p = 0.95). (auth)

27249 POLAROGRAPHIC AND COULOMETRIC DETERMINATION OF TECHNETIUM. G. B. S. Salaria, Charles L. Rulfs, and Philip J. Elving (Univ. of Michigan, Ann Arbor). Anal. Chem., 35: 979-82(July 1963).

Since technetium in any oxidation state can be readily converted to Tc(VII), the selective determination of the latter will allow technetium to be determined in most types of samples in which it may be expected to occur. The polarographic and coulometric determination of Tc(VII) was consequently investigated. Measurement of Tc(VII) wave I at pH 2 generally results in optimum selectivity and sensitivity, with the measurement of wave I or II at pH 13 being used if interfering polarographic waves occur at pH 2, or for equally cogent reasons. Measurement of catalytic wave III at pH 13 affords maximum sensitivity for the estimation of technetium at very low concentration levels. Technetium can also be accurately determined by controlled potential electrolysis and coulometric measurement. The feasibility of determining technetium polarographically in complex mixtures is indicated by the opportunity of using different waves at radically different pH values; the wave used would be determined by the location of the polarographic waves given by other sample components. Technetium can be readily determined in the presence of rhenium at pH 2; technetium and rhenium in admixture can be simultaneously determined by polarography in 2M hydrochloric acid. (auth)

27250 THE DETERMINATION OF PLUTONIUM BY (ETHYLENE DINITRILO)TETRAACETIC ACID TITRATION. W. B. Brown, D. R. Rogers, E. A. Mershad, and W. R. Amos (Mound Lab., Miamisburg, Ohio). Anal. Chem., 35: 1000-2(July 1963).

A direct and an indirect (ethylene dinitrilo)tetraacetic acid (EDTA) titration for the determination of plutonium was developed. A solution containing from 8 to 40 mg of plutonium is buffered between pH 2.5 and 3.0, heated to boiling, and titrated with EDTA to a copper–1-(2-pyridylazo)-2-naphthol (Cu–PAN) end point. The indirect procedure is a continuation of the direct procedure. Ammonium fluoride solution, buffered at pH 3, is added to the titrated sample. Fluoride ions stoichiometrically demask EDTA from the plutonium chelate. The uncomplexed EDTA is titrated with standard copper solution to a PAN end point. For samples containing between 8 and 40 mg of plutonium, the mean error of the direct method was less than ±0.1 mg, and the mean error of the indirect method was less than ±0.2 mg. The standard deviation of 10 titrations performed on samples containing 14.0 mg of plutonium was ±0.08 for both the direct and the indirect methods. The indirect procedure is relatively free from interfering anions and cations. (auth)

27251 A CONTINUOUS PHOTOMETRIC FLUORINE ANALYZER. C. W. Weber and O. H. Howard (Oak Ridge Gaseous Diffusion Plant, Tenn.). Anal. Chem., 35: 1002-5 (July 1963). (TID-16941)

A sensitive automatic analyzer was developed for the continuous determination of elemental fluorine in gas mixtures. As the sample stream is passed through hot sodium chloride, the fluorine quantitatively liberates chlorine, which is measured at 350 mμ in a pressure-controlled flow colorimeter cell. The range of the analyzer, calibrated with standard fluorine-nitrogen mixtures, is 0.05 to 15 mole % of fluorine, using a 10-cm cell at 500 mm of Hg. The relative standard deviation of the fluorine analyzer is about ±1.5% above 0.8% fluorine, and the standard deviation is about ±0.04 (absolute) at lower levels. Initial response lag is 6 seconds, with full response in about 1 minute. The instrument is applicable in the presence of hydrogen fluoride and other gases which do not absorb radiation near 360 mμ or liberate chlorine from sodium chloride. (auth)

27252 QUANTITATIVE RADIOCHEMICAL PROCEDURE FOR ANALYSIS OF POLONIUM-210 AND LEAD-212 IN MINERALS. Hugh T. Millard, Jr. (California Inst. of Tech., Pasadena). Anal. Chem., 35: 1017-23(July 1963).

A method for the analysis of polonium-210 (138.4-day half life) and lead-212 (10.6-hour half life) in zircons and other natural systems was developed. The procedure employs spontaneous electrodeposition on silver for the isolation of polonium-210 and controlled-potential electrogravimetric separation of lead-212 plus added lead carrier. A diethyldithiocarbamate extraction procedure for the lead was developed to be used prior to plating in the presence of ions which precipitate at the pH used for lead deposition. The amounts of the deposited nuclides are then determined by alpha counting. The effects of temperature, volume, and inhibiting ions on the yield and rate of deposition of polonium were also studied. The procedure was calibrated using minerals whose lead-210 and thorium-232 contents had been determined by other methods; it was tested on a composite uraninite-thorite mixture. Finally, it was applied in the analysis of four zircon samples and one uranothorite sample. (auth)

27253 NEUTRON ACTIVATION AND RADIOCHEMICAL DETERMINATION OF THE MOLYBDENUM, CHROMIUM, AND IRON CONTENT OF INDIVIDUAL STAINLESS STEEL MICROSPHERES. Philip A. Benson and Chester E. Gleit (Tracerlab, Richmond, Calif.). Anal. Chem., 35: 1029-32 (July 1963).

Stainless steel microspheres, with weights between 4.7×10^{-9} and 3.9×10^{-8} gram, are isolated on methyl methacrylate films. After measurement of particle diameters by optical microscopy, the specimens are encapsulated in lead foil and irradiated with an intense flux of neutrons. Radiochemical procedures are used to isolate the Mo^{99}, Cr^{51}, $Fe^{55,59}$, and Np^{239} fractions. The abundance of molybdenum, chromium, and iron in the individual spheres is determined from the measured activities. The experimental error is attributed to three principal sources. Uncertainty in particle diameters as measured by optical microscope produced a relative error of 6 to 11%. Radiochemical variations led to a relative error of 5%. Contamination of the sample was successfully controlled in the Mo and Cr analyses. Impuri-

ties in the encapsulating lead foil were the largest source of error in the iron determination. (auth)

27254 NOVEL RADIOTRACER METHOD FOR FLUORIDE DETERMINATION. Fletcher L. Moore (Oak Ridge National Lab., Tenn.). Anal. Chem., 35: 1032-4 (July 1963).

A new, simple, rapid method for the determination of fluoride ion is based on the radiotracer principle. Under highly selective conditions, tantalum-182 is extracted from 6.5M sulfuric acid solution as a fluoride complex into diisobutylketone. The amount of radioactivity extracted is proportional to the fluoride ion concentration. The counting rate is linear over the range 400 to 840 μg of fluoride ion; below 400 μg it is nonlinear but reproducible and useful. The sensitivity is about 40 μg of fluoride ion. The radiotracer method exhibits relatively high tolerance to some of the serious interferents of other methods. Several useful applications of the method are discussed. (auth)

27255 THE SEPARATION AND FLUORESCENT X-RAY SPECTROMETRIC DETERMINATION OF ZIRCONIUM, MOLYBDENUM, RUTHENIUM, RHODIUM, AND PALLADIUM IN SOLUTION IN URANIUM-BASE FISSIUM ALLOYS. J. O. Karttunen (Argonne National Lab., Ill.). Anal. Chem., 35: 1044-9 (July 1963). (TID-18359)

The various elements are separated prior to the fluorescent x-ray determination because of either direct x-ray line interference or negative interference to the characteristic x-ray intensities caused by the presence of the other elements in the solution. Palladium is precipitated with dimethylglyoxime, and the precipitate is extracted with chloroform. The aqueous portion is made 6M in hydrochloric acid and is passed through a Dowex 1-X8 anion exchange resin. Zirconium and rhodium do not adsorb, uranium is eluted with 0.3M hydrochloric acid, ruthenium and molybdenum are eluted with 8M nitric acid. The various elements are then determined by counting their K alpha radiation using a lithium fluoride plane crystal for dispersion. (auth)

27256 X-RAY EMISSION ANALYSIS OF PLUTONIUM AND URANIUM COMPOUND MIXTURES. Oscar Menis, E. K. Halteman, and E. E. Garcia (Nuclear Materials and Equipment Corp., Apollo, Penna.). Anal. Chem., 35: 1049-52 (July 1963).

A timesaving and reliable x-ray emission method was developed for the simultaneous determination of plutonium and uranium in refractory oxide mixtures and fused alloys. The measurements of characteristic Lα lines of uranium and plutonium, with thorium used as an internal standard, were carried out after a fusion of the refractory mixtures in a flux of potassium pyrosulfate. A casting technique, which involves slow cooling of the molten flux mixture, was developed as a substitute for the more lengthy briquetting procedure. For samples of uniform composition, calibration curves and plutonium-to-uranium intensity ratios can be used. In these cases, the relative standard deviation is less than 0.4%. With complex mixtures containing a high percentage of other elements, thorium is used as an internal standard. A mechanism is also proposed to explain the positive curvature in the intensity ratio values for uranium to thorium and plutonium to thorium. This is due to the autoexcitation phenomena characteristic of uranium and transuranium elements. (auth)

27257 INERT GAS FUSION DETERMINATION OF OXYGEN IN VANADIUM, NIOBIUM, AND TANTALUM. George J. Kamin, Jerome W. O'Laughlin, and Charles V. Banks (Iowa State Univ., Ames). Anal. Chem., 35: 1053-4 (July 1963). (IS-614)

The inert gas fusion technique was applied to the determination of oxygen in the Group V-A metals—vanadium, niobium, and tantalum. A platinum flux technique was satisfactory for the determination of oxygen in vanadium and a mixed nickel–platinum bath used with a platinum flux technique was satisfactory for niobium and tantalum. Oxygen contents from 100 to 1000 ppm were determined on standard samples with relative standard deviation of 3% for vanadium and 5% for niobium and tantalum. (auth)

27258 RAPID TITRIMETRIC DETERMINATION OF ORTHOPHOSPHATE WITH CEROUS ION. APPLICATIONS TO TECHNICAL GRADE INORGANIC PHOSPHATES. T. A. Taulli and R. R. Irani (Monsanto Chemical Co., St. Louis). Anal. Chem., 35: 1060-3 (July 1963).

A sensitive and rapid volumetric titration procedure is described for the determination of macro and semimicro amounts of orthophosphate. Orthophosphate titration with cerous ion in a buffered medium at pH 7.0 to 9.5, using Eriochrome Black T indicator affords a visual colorimetric endpoint. Concentrations as low as 0.4 μg per ml of phosphorus were measured. Accuracy at the 95% confidence limits of ±0.38% phosphorus (absolute) for pure and industrial grade orthophosphates containing 8 to 26% phosphorus was obtained; corresponding precision was found to be ±0.24%. Interference studies with typical ions were conducted. Excluding polyphosphate anions, cation interference, especially ferric ion, was more serious than anion interferences. (auth)

27259 DETERMINATION OF RHODIUM IN RHODIUM–URANIUM ALLOYS BY PRECIPITATION WITH HYDROGEN SULFIDE. E. June Maienthal (National Bureau of Standards, Washington, D. C.). Anal. Chem., 35: 1094-5 (July 1963).

A method for the gravimetric determination of Rh as the sulfide was developed which is applicable to U alloys containing 2 to 56% Rh. The method involves the overnight digestion of the precipitate and the leaching of U from the precipitate with dilute HNO_3. (D.L.C.)

27260 DETERMINATION OF ALUMINUM IN ORGANO–ALUMINUM COMPOUNDS BY X-RAY FLUORESCENCE. H. F. Smith and R. A. Royer (Continental Oil Co., Ponca City, Okla.). Anal. Chem., 35: 1098-9 (July 1963).

An x-ray fluorescence method was developed for the determination of Al in highly reactive, liquid organo-aluminum compounds over the range of 0.05 to 10%. A chromium x-ray target tube and a pulse height discriminator are used. (D.L.C.)

27261 SPOT TEST FOR BERYLLIUM BASED ON COLOR REACTION WITH ERIOCHROME CYANINE R. Patricia R. Mohilner (Louisiana State Univ., Baton Rouge). Anal. Chem., 35: 1103-4 (July 1963).

The spot test, based on the reaction with Eriochrome Cyanine R used for the spectrophotometric determination of Be, has a detection limit of 0.1 μg Be in a test drop. A buffer solution and a masking solution of sodium potassium tartrate and disodium EDTA are used. No ions interfered at 50-μg levels with 1 μg Be. (D.L.C.)

27262 THE FORMATION OF HIGHLY FLUORESCENT ZINC PHOSPHATE IN THE PRESENCE OF URANIUM AND ITS APPLICATION TO THE DIRECT FLUORIMETRY OF URANIUM IN AQUEOUS MEDIA. Giulio Alberti and Alberto Saini (CNEN, Rome). Anal. Chim. Acta, 28: 536-42 (June 1963). (In English)

The formation and composition of highly fluorescent zinc phosphates in the presence of traces of uranium were investigated, and a direct fluorimetric determination of uranium in aqueous media was developed, based on the

formation of finely dispersed and stabilized fluorescent precipitates. The standard deviation for 20 μg of uranium in 25 ml is 5%; with the fluorimeter described, 10^{-2} μg of uranium per ml can be determined with an error of 50%. The method is very selective and can be employed for analysis of uranium in ores; it is less sensitive than conventional fluorimetry of fused alkali fluorides but is much simpler and faster. Interferences can often be eliminated by suitable masking reactions. (auth)

27263 3-OXIMINOMETHYLSALICYLIC ACID AS A REAGENT FOR THE GRAVIMETRIC DETERMINATION OF THORIUM. Asit Kumar Ray (Indian Association for the Cultivation of Science, Calcutta). Anal. Chim. Acta, 28: 580-3(June 1963). (In English)

3-Oximinomethylsalicylic acid was prepared and examined for the determination of Th and its separation from rare earths and other ions. The new reagent gave better separations than salicylic acid and ammonium salicylate, but it was necessary to ignite the precipitate to ThO_2 for gravimetric determination. (D.L.C.)

27264 A METHOD FOR RADIOCHEMICAL SEPARATION OF MOLYBDENUM. S. M. Qaim and F. D. S. Butement (Univ. of Liverpool). Anal. Chim. Acta, 28: 591-2 (June 1963). (In English)

A modified method is outlined which is rapid and specific for Mo in proton-irradiated Mo. Volatile elements are removed by heating, and Sr and Nb are precipitated as nitrate and oxide. Other activities are precipitated by NH_3 neutralization and $Fe(OH)_3$ scavenging. Finally, Mo is complexed with phosphate and precipitated with nitron reagent. (D.L.C.)

27265 DETERMINATION OF BORON IN ZIRCONIUM, HAFNIUM AND TITANIUM. W. T. Elwell and D. F. Wood (Imperial Metal Industries (Kynoch) Ltd., Birmingham, Eng.). Analyst, 88: 475-6(June 1963).

Procedures were developed for the determination of boron in Zr and Ti and trace amounts (less than 0.5 ppm) in reactor-grade Zr, Zr alloys, and Hf using curcumin. (P.C.H.)

27266 AUTORADIOGRAPHIC QUANTITATIVE DETERMINATION OF URANIUM. Antonio Catino (Università, Turin). Ann. Chim. (Rome), 52: 184-6(Feb.-Mar. 1962). (In Italian)

An autoradiographic method for the fast determination of uranium is described. The method is based on the measurement of the blackening of a photographic plate after exposure to radiations emitted by the radioactive material. It is precise up to 5%. (tr-auth)

27267 A SIMPLE METHOD DETERMINING GOLD IN BIOLOGICAL MATERIAL BY NEUTRON ACTIVATION ANALYSIS. M. Rakovic (Charles Univ., Prague). Atompraxis, 9: 177-8(May 1963). (In English)

A method of neutron activation analysis for the determination of gold in biological material, based on the chemical separation of gold by doubled precipitation with oxalic acid and on counting with a Geiger-Müller tube, is described. The accuracy of this method to ±5% for determining 10^{-7} to 10^{-6} g of gold. It makes it possible to determine up to 10^{-8} g of gold with less accuracy. (auth)

27268 OUTLINE OF A METHOD FOR CORRECTING FOR ATOMIC NUMBER EFFECTS IN ELECTRON PROBE MICROANALYSIS. P. M. Thomas (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Brit. J. Appl. Phys., 14: 397-8(June 1963).

The concentration determination of elements in various alloys by the electron probe microanalysis method is discussed. The atomic number effects on the variation of the factor for back-scattered electrons are corrected. Numerical results of measured concentrations are obtained from corrected intensity ratios. (C.E.S.)

27269 PHOTOMETRIC DETERMINATION OF URANIUM IN REACTOR MATERIALS BY THE HYDROGEN PEROXIDE METHOD. Eugene N. Pollock and Laura F. White (Nuclear Metals, Inc., West Concord, Mass.). Chemist-Analyst, 52: 70-1(July 1963).

The alkaline peroxy method was modified for application to reactor materials including U–Zr alloys and U–Zircaloys without prior separation of U. Tartaric acid and nitrilotriethanol are used to reduce the interference of Fe, Ni, and V, and Cr is prevented from interfering by making photometric measurements at two wavelengths. (D.L.C.)

27270 DIRECT READING SPECTROCHEMICAL ANALYSIS OF MATERIALS OF NUCLEAR INTEREST. M. Roca Adell (Junta de Energia Nuclear, Madrid), F. Álvarez González, and R. Fernández Cellini. Energia Nucl. (Madrid), 6: 4-18(Oct.-Dec. 1962). (In Spanish)

A detailed description, including a discussion of the operating conditions, operating program, and variables affecting the precision, is given of the quantometer used for the spectrochemical analysis of nuclear materials. The application of the instrument to geochemical prospecting for U, study of U minerals, and analysis of U, Al, Mg, Zr, and graphite is indicated. (J.S.R.)

27271 APPLICATION OF THE METHOD OF CALCULATION OF INTENSITY RATIOS TO THE DETERMINATION OF IMPURITIES IN ALUMINUM AND SAP. Z. Hainski and G. Rossi (Euratom CCR, Ispra, Italy). Energia Nucl. (Milan), 10: 247-58(May 1963). (In Italian)

The method of determination of intensity ratios is applied to the determination of impurities in Al and SAP. Curves for determining the impurities are drawn, based on a standard sample of 99.5%-pure Al. The results are compared with those obtained by classical calibration methods. The presence of Al in varying concentrations in SAP does not seem to influence the spectrographic determination of the impurities, although certain anomalies are observed. (tr-auth)

27272 QUALITY CONTROL INSTRUMENTATION. PART 1. GAS-LIQUID CHROMATOGRAPHY. J. T. Miller. Instr. Pract., 17: 627-37(June 1963).

The principles of gas-liquid chromatography are described briefly. The various components of a gas-liquid chromatograph are described in some detail: columns, carrier, gas, sample valve, detectors, etc. Ionization detectors are discussed in more detail. The presentation and interpretation of the results are considered. (D.L.C.)

27273 GAS ANALYSIS OF TRITIUM IN THE FORM OF ETHANE. S. Mlinkó (Central Research Inst. for Chemistry, Hungarian Academy of Sciences, Budapest) and T. Szarvas. Intern. J. Appl. Radiation Isotopes, 14: 197-203(June 1963). (In English)

A new simplified technique for gas assays of tritium is described. The method is based on the combustion of the labelled compound and on the indirect conversion of the combustion water to ethane. Combustion and conversion are carried out according to procedures used for the purpose of microanalysis of organic substances, by means of a combustion system with built-in tube fillings. No vacuum is needed for the assays. The method furnishes quantitative activity yields and reduces the possibility of isotope fractionation. (auth)

27274 A COMPUTER PROGRAM FOR AUTOMATED TESTING AND REDUCTION OF LIQUID SCINTILLATION COUNTING DATA. F. A. Blanchard (Dow Chemical Co., Midland, Mich.). Intern. J. Appl. Radiation Isotopes, 14: 213-19(June 1963). (In English)

The radioassay of β-containing tracer samples with an automatic liquid scintillation counter can generate enormous quantities of counting data. This requires, for its best use, a considerable amount of sorting, testing, averaging, calculating the effect of background and counting efficiency, and converting into various units. An ALGOL program for handling such data, presented as punched paper tape output from a Tri-Carb Liquid Scintillation Spectrometer, was prepared for a Burroughs 220 computer. It has sufficient flexibility to permit a wide variation of arrangement of test, standard, and background samples, and for the use of various supplementary multiplying and dividing factors. Data enter the computer as sample number, time counted, and the counts in two pulse height channels plus constants and control numbers. Count rates are determined, critically examined, then acceptable ones for each sample are averaged and converted to disintegrations per minute. By using an appropriate sample arrangement and constants, the results can be obtained in such directly usable units as ppm of radioactive compound in the samples being analyzed. The use of this program greatly reduces the amount of time spent on calculations; it improves the accuracy of results by eliminating personal errors of transcription and arithmetic and by discarding data falling outside of normal counting statistics. (auth)

27275 ON THE QUANTITATIVE ASSAY OF RADIOCHROMATOGRAMS BY LIQUID SCINTILLATION COUNTING. J. Willenbrink (Universität, Bonn). Intern. J. Appl. Radiation Isotopes, 14: 237-8(June 1963). (In English)

It is possible to obtain accurate results with the normal liquid scintillation method for the assay of radioactive paper strips, if the solubility of the radioactive compound being measured in the scintillation fluid is taken into account. A technique for taking this solubility into account is described which involves the replacement of the radioactive paper strip in the sample container by an inactive paper strip and the use of a standard radioactive paper strip. The ratio of efficiencies for activity in solution and on the strip was determined for three different papers. (D.L.C.)

27276 RADIOCHEMICAL DETERMINATION OF STRONTIUM-90. John H. Harley (U. S. Atomic Energy Commission, New York). J. Assoc. Offic. Agr. Chemists, 46: 371-80(June 1963).

Detailed procedures were developed for strontium-90 in foods and agricultural materials. Strontium-90 must be isolated from the bulk matrix of the sample, generally by wet or dry ashing followed by chemical or ion exchange. Non-radioactive strontium is added as a carrier because of the small mass of strontium-90. Final determination is made by letting strontium-90 and yttrium-90 attain radioactive equilibrium, separating the yttrium-90, and measuring its activity. Yield is determined radiometrically with strontium-85 tracer. Strontium-89 is determined at the same time by the same radiochemical procedures, except that the yield is determined gravimetrically. (auth)

27277 DETERMINATION OF CESIUM-137. John H. Harley (U. S. Atomic Energy Commission, New York). J. Assoc. Offic. Agr. Chemists, 46: 380-4(June 1963).

Many methods are available for determination of cesium-137, no one of which has overwhelming advantages. Common features of such methods are discussed, and a unified procedure, suitable for collaborative study, is outlined. (auth)

27278 MASS SPECTROMETRY OF SOLIDS. H. W. Wilson and N. R. Daly (Atomic Weapons Research Establishment, Aldermaston, Berks, Eng.). J. Sci. Instr., 40: 273-85(June 1963).

This article describes the techniques used for the isotropic and chemical analysis of solid materials employing the mass spectrometer as an analytical tool. It describes in detail the types of ion sources and detectors needed for this work, and reviews some of the more recent developments in these fields. Spark source mass spectrometry is discussed, and applications of the mass spectrometer to nuclear physics, isotope dilution, geology, thermodynamic studies, and field ionization are discussed. (auth)

27279 A THEORETICAL STUDY OF THE USE OF INTERNAL STANDARDS FOR PRECISE ISOTOPIC ANALYSIS BY THE SURFACE IONIZATION TECHNIQUE: PART I. GENERAL FIRST-ORDER ALGEBRAIC SOLUTIONS. M. H. Dodson (University Museum, Oxford). J. Sci. Instr., 40: 289-95(June 1963).

Mass discrimination is a variable and unpredictable source of systematic error in mass spectrometric analysis using surface ionization techniques. A method of eliminating it through an internal standard technique is investigated. To simplify the algebra, a method of describing mass discrimination was developed which is symmetrical with respect to all isotopes in a sample. A set of equations for mixtures of samples with different isotopic compositions is set up and solved for elements with three or four isotopes, four isotopes giving the simplest solutions. The solutions can be applied to quantitative analysis by the isotopic dilution technique, to the measurement of absolute isotopic abundances and to the measurement of relative abundances of samples of polyisotopic elements which have undergone isotopic fractionation. To make the most of these proposals the precision of measurement of ion current ratios from thermal ionization sources must be improved. (auth)

27280 NONDISPERSIVE X-RAY SPECTROCHEMICAL ANALYSIS USING NUCLEAR BETA RAY SOURCE. Shigemasa Enomoto and Chizuo Mori (Government Industrial Research Inst., Nagoya, Japan). Japan J. Appl. Phys., 2: 274-80(May 1963). (In English)

A theoretical derivation to estimate the intensity of x rays produced by nuclear beta ray excitation in pure or complex specimens is described. The approach is verified by experimental demonstrations using a Pm-147 source and a thin NaI scintillation detector for analyzing binary alloys with the illustration of nondispersive x-ray spectroscopy. (auth)

27281 ACTIVATION ANALYSIS FOR COPPER ORE SORTING. H. F. Ramdohr (Isotope-Studiengesellschaft e. V., Karlsruhe, Ger.). Kerntechnik, 5: 204-6(May 1963). (In German)

Activation analysis of irradiated copper are particles (5×10^{10} n/cm^2/sec can be carried out in a laboratory scale sorting device. The activated pieces drop through a plastic scintillation detector which counts the Cu^{64}-annihilation gamma radiation and evaluates copper content. A flipping gate is operated according to copper counting results which deviates each mineral piece into tailings or concentrate. An error introduced by the varying size of pieces in a certain size fraction can be eliminated by scanning overall activity. (auth)

27282 CONTINUOUS MEASUREMENT OF THE WATER CONTENT OF SINTERING IRON BY NEUTRON SCATTERING. W. Kuehn (Isotope-Studiengesellschaft e. V., Karlsruhe, Ger.). Kerntechnik, 5: 207-12(May 1963). (In German)

The intensity of the thermal neutrons in the vicinity of a fast-neutron source depends upon the hydrogen content and upon the material surrounding the source. The counting rate of the moderated neutrons in the immediate vicinity of the source is under certain conditions, a measure for the moisture content of the substance. It is shown that in this manner the water content of sintering iron can be measured continuously if special factors are regarded. (auth)

27283 RAPID ANALYSIS OF SECONDARY β-RADIATION IN THE METALLURGICAL LABORATORY. Rudolph Jirkovsky. Kohasz. Lapok, 95: 513-17(Nov. 1962). (In Hungarian)

An apparatus was constructed for the measurement of secondary radiation. It consists of an ionization chamber with polystyrene-insulated electrodes, an amplifier, and a measuring arrangement. A spherical filter of 0.15-mm thick Al foil is placed in the chamber cover that filters out the secondary radiation of the lower atomic number elements from the source (20 mC of Sr^{90}, Y^{90}) placed at the chamber base. The main constituents of coal are elements of lower atomic numbers (H, C, O, N), while ashes consist of elements of higher atomic numbers (Mg, Ca, Si, S, Al, Fe). There is a direct relation between the ash content and the secondary β radiation. Thus the largest H content and smallest Fe_2O_3 will produce the weakest secondary β radiation and vice versa. It was also demonstrated that the metal contents of ores are directly proportional to the intensity of the secondary β radiation. This method requires only that the sample be in grain size of 1.5 mm or less and dried at 105°C. The measurements and blank determinations take only 3 to 5 min and determine metal content to 0.2 to 0.5% and ash content to 2% accuracy. (TCO)

27284 DETERMINATION OF IMPURITIES IN A P^{32} ISOTOPE PREPARATION BY THE USE OF A HUMUS PREPARATION. Mária Szilágyi. Magy. Tud. Akad. Atommag Kutato Intezete (Debrecen) Kozlemen., 3: 3-9 (Apr. 1961). (In Hungarian)

Samples of P^{32} preparations (pH 9 and 9.3) containing minute quantities of radioactive impurities of Zn^{65}, Fe^{55-59}, and Sb^{124} (5 and 10 mC) were passed through a column of peat (humus) with excellent absorbency of heavy ions. The impurities were trapped in the humus and released by washings and identified individually in the washings by the use of γ spectrometry. It was determined that Sb^{124} exists in the form of anions, and in addition, an unreported impurity of Co^{60} was also present. (OID)

27285 NATURALLY OCCURRING ALPHA-EMITTING NUCLIDES IN THE HUMAN BODY. B. Rajewsky and W. Stahlhofen (Max Planck-Institut für Biophysik, Frankfurt am Main). Nature, 198: 960-2(June 8, 1963).

A technique is described for measuring naturally occurring α-emitting radioisotopes in human bone ashes by means of ZnS screens. Counting efficiency was improved by mixing the sample and the scintillating Ag-activated ZnS. The method was examined for the influence of the parameter on the counting rate. Results are presented from measurements of Th^{228}, Ra^{226}, Pb^{210}, and Po^{210} in bone samples. (C.H.)

27286 DETERMINATION OF TRACE OF BORON IN HIGHLY PURIFIED GRAPHITE BY EMISSION SPECTROGRAPHIC ANALYSIS. Hisao Osawa and Masahiko Umezu (Fuji Electric Co., Ltd., Kawasaki, Japan). Nippon Kagaku Zasshi, 84: 245-9(Mar. 1963). (In Japanese)

An emission spectrographic method applicable to the determination of extremely low concentration of boron in highly purified graphite for an atomic reactor is described. The strong current d-c arc excitation and carrier distillation of boron carbide-sodium fluoride-graphite mixtures were applied in the procedures. Studies on the variation of analytical intensity during excitation and on the effect of changing arc current, arc voltage, gap, and form of electrode on the intensity values were included. As a result, it was found that an amount of 0.04 ppm boron in the graphite was determined in air without any chemical concentration. The experimental error of the method may be about 10%. (auth)

27287 SPECTROPHOTOMETRIC DETERMINATION OF RUTHENIUM AS THE THIOCYANATE COMPLEX. Yoshinaga Oka and Toyoaki Kato (Tohoku Univ., Sendai). Nippon Kagaku Zasshi, 84: 254-8(Mar. 1963). (In Japanese)

The color forming processes of Ru with thiocyanate from violet-blue species were investigated and the experimental conditions for subsequent spectrophotometric determination of ruthenium were established. In the presence of HCl up to 1.0 mole/l, maximum color development with 0.5 mole/l NH_4NCS was attained on heating for 15 min at 70°C. Beer's law was obeyed over the concentration range, 1 to 15μg Ru per ml. The molar absorptivity of the colored species is approximately 5900 at its maximum absorbance of 585mμ. Rhodium, iridium, palladium, and platinum produced no interference but osmium formed the orange species with thiocyanate under the condition described. (P.C.H.)

27288 THE URANYL TROPOLONE-5-SULFONIC ACID CHELATE AND ITS USE IN THE DETERMINATION OF URANIUM. Yoshinaga Oka, Katsumi Yamamoto, and Masatake Katagiri (Tohoku Univ., Sendai). Nippon Kagaku Zasshi, 84: 259-62(Mar. 1963). (In Japanese)

In the pH range between 1.1 and 3.1, it was found that a yellow 1:1 chelate, which shows an absorption maximum at 395mμ, was formed by the reaction of tropolone-5-sulfonic acid and uranium. Within the pH range from 3.4 to 4.2, a 1:2 chelate was formed, and its absorption maximum was found at 396mμ. The stability constants of the 1:1 and 1:2 chelates were 7.2×10^6 and 4.6×10^4 at 25°C, respectively. When the pH was raised gradually from 4.4 to 6.9, a considerable variation was observed in the shape of absorption curves, the maxima being shifted towards longer wavelengths. The acid dissociation constant of ammonium tropolone-5-sulfonate was found to be 8.6×10^{-6} at 25°C. Uranium can be determined by the use of the 1:1 chelate at concentrations as low as 1γ/ml. The solution conforms to Beer's law. The molar extinction coefficient of 1:1 chelate was 5800 at 395mμ. (auth)

27289 DETERMINATION OF HAFNIUM IN ZIRCONIUM BY NEUTRON ACTIVATION ANALYSIS. Yuichiro Kamemoto and Shigeru Yamagishi (Japan Atomic Energy Research Inst., Tokyo). Nippon Kagaku Zasshi, 84: 270-2 (Mar. 1963). (In Japanese)

A method was devised for the non-destructive determination of hafnium in zirconium metal and zirconium compounds by neutron activation analysis. About 100 mg. of zirconium sample was irradiated along with standard at a neutron flux of about 3×10^{11} n/cm^2/sec for 3 days (total irradiating period was about 15 hr.). After irradiation, the sample was allowed to stand for about 2~4 days to cool out the activity of short half life nuclides and then hafnium was determined by gamma ray spectrometry, comparing the peak heights of 0.066 and 0.14 Mev gamma

rays from Hf^{181} with those from the standard. Hafnium of 0.06 to 1.1% was determined. The method is more useful in routine analysis than the activation method using Hf^{179m} in point of half life of nuclide. (auth)

27290 DETERMINATION OF ALUMINUM BY DOUBLE ACTIVATION ANALYSIS. Yuichiro Kamemoto and Shigeru Yamagishi (Japan Atomic Energy Research Inst., Tokyo). Nippon Kagaku Zasshi, 84: 291(Mar. 1963). (In Japanese)

Double neutron activation analysis was studied and applied to the determination of aluminum. The sample was irradiated for 3 min at a neutron flux of 3×10^{11} n/cm^2/sec. After the addition of aluminum carrier to the irradiated sample, radiochemically pure Al^{28} was separated as aluminum oxinate from the sample by extraction with 5 ml of benzene. γ-Ray spectrum of Al^{28} was measured by a pulse height analyzer and the height of photopeak at 1.78 Mev of Al^{28} was determined. The chemical yield of the purification step was determined by the re-irradiation of separated aluminum-oxinate solution for 10 sec and by comparing the activity of Al^{28} with that of standard reference sample. Content of aluminum in the sample was determined by the activity of Al^{28} which was produced by the first irradiation and corrected for the chemical yield. (auth)

27291 GAMMA-RAY ABSORPTIOMETRY DETERMINES TOTAL URANIUM IN FLAT FUEL ELEMENTS. Leslie C. Nelson, Jr. (Atomic Energy Commission, New Brunswick, N. J.). Nucleonics, 21: No. 6, 88-9(June 1963).

A method for determining the total U in flat fuel elements nondestructively and independently of U^{235} content and cladding metal or alloy composition is described. The absorption of the Eu 0.34-Mev gamma ray is measured to give the apparent U thickness, and a micrometer measurement of the total fuel element thickness permits correction for absorption by the cladding metal. Results obtained with U clad in stainless steel and Zr proved the feasibility of the method. (D.C.W.)

27292 BENZENE METHOD MEASURES TRITIUM IN RAIN WITHOUT ISOTOPE ENRICHMENT. M. A. Tamers and R. Bibron (CEN, Saclay, France). Nucleonics, 21: No. 6, 90; 92-4(June 1963).

A method for measuring the tritium activity in rain by converting the water samples to benzene and counting in a liquid-scintillation counter is described. This method gives results in good agreement with results of other methods and exhibits good reproducibility. (D.C.W.)

27293 NUCLEAR METHODS OF OXYGEN ANALYSIS. L. C. Bate (Oak Ridge National Lab., Tenn.). Nucleonics, 21: No. 7, 72; 74-5(July 1963).

Methods utilizing various reactions to determine trace quantities of oxygen in various materials are discussed. Methods involving triton reactions are noted to offer greater adaptability and sensitivity, while methods using gamma, neutron, and other charged-particle reactions leave the samples undamaged. 40 references. (D.C.W.)

27294 AN EXTENSION OF THE LIMITS OF APPLICABILITY OF THE SELF-ABSORPTION METHOD. N. G. Preobrazhenskii. Opt. Spectry. (USSR) (English Transl.), 14: 183-7(Mar. 1963).

A generalized theory of the self-absorption of spectral lines is proposed and applied to a modification of Podmoshensky's retracing technique. Radial inhomogeneity in plasma is taken into account and symmetrical shapes of absorption and emission line contours (Doppler, dispersion, Voigt, and Dieke contours) are considered. The accuracy of the method is discussed; possible applications of it are given. A simple analytical method of measuring the optical densities of lines with hyperfine structure is described. (auth)

27295 DETERMINATION OF THORIUM IN GRANITE BY GAMMA SPECTROMETRY AND BY RADIOTRACER. S. A. Reynolds (Oak Ridge National Lab., Tenn.). Talanta, 10: 611-19(June 1963). (In English)

Thorium in granite samples has been determined by gamma-spectrometric measurement of the 2.6-Mev gamma radiation from thallium-208, a daughter. Concentrations ranged from a few to several hundred ppm, and both untreated and leached samples were analysed. Thorium-234 tracer was successfully applied in finding the sources of error in a difficult chemical analysis and, upon suitable treatment, obtaining the correct analytical values. This study affords an example of the use of a tracer in analysis, and is somewhat unusual in that both negative and positive deviations were discovered. Agreement between results by the two independent methods was quite good. (auth)

27296 ANION EXCHANGE OF URANIUM, THORIUM, IRON AND ALUMINIUM IN MINERAL ACID-ETHER SOLUTIONS. SEPARATION OF URANIUM FROM THORIUM, ALUMINIUM AND IRON. S. Urubay, J. Korkisch, and G. E. Janauer (Universität, Vienna). Talanta, 10: 673-8 (June 1963). (In English)

The adsorption behavior is described of uranium, thorium, iron(III), and aluminium on the strongly basic anion exchanger Dowex 1 in mixtures of ethers with hydrochloric or nitric acid. The distribution coefficients of these elements were determined in diethyl and di-isopropyl ether as well as in dioxan. Based on these results, separation methods for uranium, thorium, iron, and aluminium were developed. (auth)

27297 A NEW PRINCIPLE OF ACTIVATION ANALYSIS SEPARATIONS. II. SUBSTOICHIOMETRIC DETERMINATION OF TRACES OF ZINC AND COPPER IN GERMANIUM DIOXIDE. Adolf Zeman, Jaromír Růžička, and Jiří Starý (Technical Univ., Prague). Talanta, 10: 685-9 (June 1963). (In English)

A substoichiometric determination of zinc and copper in germanium dioxide is based on dissolution of the irradiated sample in sodium hydroxide followed by addition of known amounts of carriers for the metals to be determined, then adjustment to suitable conditions for extraction. An irradiated standard sample is treated simultaneously in exactly the same way. The solutions thus prepared are extracted with substoichiometric amounts of dithizone in carbon tetrachloride and the amounts of zinc and copper in the germanium dioxide calculated from the activities of the extracts obtained. The present procedure is far more simple and rapid than previously published methods. It eliminates not only distillation but also many separation steps commonly used, thus shortening the time of analysis to 20 min. (auth)

27298 DETERMINATION OF SMALL AMOUNTS OF ZIRCONIUM. I. GRAVIMETRIC PROCEDURES USING MANDELIC ACID AND ITS DERIVATIVES. Mohammed Rafiq, Charles L. Rulfs, Philip J. Elving (Univ. of Michigan, Ann Arbor). Talanta, 10: 696-700(June 1963). (In English)

The limiting factors were investigated for precipitation of zirconium at the milligram level by mandelic acid, *p*-bromomandelic acid, and *m*-nitromandelic acid; the latter has only been briefly studied previously. Optimum conditions were determined for quantitatively precipitating zirconium at 0.1- and 1-mg levels. (auth)

27299 PRECIPITATION FROM HOMOGENEOUS SOLUTION WITH N-BENZOYLPHENYLHYDROXYLAMINE ACETATE. Paul R. Ellenfsen (Case Inst. of Tech., Cleveland), Louis Gordon, R. Belcher, and William G. Jackson. Talanta, 10: 701-3(June 1963). (In English)

A preliminary study was made of the use of N-benzoylphenylhydroxylamine acetate as a source of N-benzoylphenylhydroxylamine in precipitation from homogeneous solution. Initial experiments with a model system in which the separation of copper from cobalt and cadmium was studied demonstrated the superior applicability of N-benzoylphenylhydroxylamine acetate over N-benzoylphenylhydroxylamine as a precipitant. (auth)

27300 SELECTIVE SPOT TEST FOR EUROPIUM IN THE PRESENCE OF OTHER RARE EARTHS. Ervin Jungreis and Ezra Levy (Hebrew Univ., Jerusalem). Talanta, 10: 708(June 1963). (In English)

A new spot test for the detection of europium is described, based on the redox reaction between Eu^{2+} and phosphomolybdic acid. The test is specific for europium in the presence of all other rare earth elements. (auth)

27301 SOIL DENSITY DETERMINATION USING THE γ-RAY SCATTERING METHOD. Ljubomir Nedeljkovic. Tehnica, 17: 633-8(1962). (In Serbo-Croatian)

In experimental laboratory equipment, density measurement was made of artificially compressed layers of soil and sand using the method of gamma-ray scattering from a 15-mC Co^{60} source. In spite of the equipment shortcomings, satisfactory results were obtained. It was observed that in a density area of 1 g/cc, the quantity of scattering radiation can be taken as the measure for density determination. The laboratory equipment minimum variation that could be observed was ±0.025 g/cc. It was decided that such an equipment is to be procured so as to enable suitable measuring under field conditions. (OID)

27302 4-CHLOROBENZENE-2-PHOSPHONIC ACID-(1-AZO-1)-2-HYDROXYNAPHTHALENE-3,6-DISULFONIC ACID (CHLORPHOSPHONAZO R) AS A REAGENT FOR THE PHOTOMETRIC DETERMINATION OF BERYLLIUM. V. F. Luk'yanov, A. M. Lukin, E. M. Knyazeva, and I. D. Kalinina. Zh. Analit. Khim., 18: 562-6(May 1963). (In Russian)

4-Chlorobenzene-2-phosphinic acid-(1-azo-1)-2-hydroxynaphthalene-3,6-disulfonic acid (chlorphosphonazo R) is suggested for the photometric determination of Be. The reagent forms with Be a stable yellow compound; the sensitivity of the determination is 0.1 μg/ml of BeO. It permits the determination of Be in the presence of masking substances without Be separation beforehand. It is possible to determine 0.1% of Be in ore containing 10% Fe. A method for the determination of Be in ores was developed. The experimental error is not more than ±5% (relative) when the content of BeO is 0.05 to 0.5%. When less than 0.05% of BeO is determined, the error increases up to ±10% (relative). (auth)

27303 STUDY OF RHODAMINE C AS A FLUORESCENT REAGENT FOR INDIUM. A. K. Babko and Z. I. Chalaya. Zh. Analit. Khim., 18: 570-4(May 1963). (In Russian)

Rhodamine C is the best reagent for the extraction-luminescent determination of In as bromide complex. For the determination of In by the fluorescence of benzene extracts the optimum conditions are: 3 to 6 N H_2SO_4 and 2 N KBr; the use of HCl solutions is unsuitable. The addition of acetone and other solvents into the aqueous solution before the extraction of rhodamine C bromindate increases the solubility of the In complex and does not appreciably affect the solubility of rhodamine bromide. Under the optimum conditions found, the sensitivity of the determination is 5 times higher. (auth)

27304 ANTIPYRINE AND ITS CERTAIN DERIVATIVES AS ANALYTICAL REAGENTS FOR CERIUM(IV). N. A. Kanaev. Zh. Analit. Khim., 18: 575-84(May 1963). (In Russian)

The photometric determination of small amounts of Ce(IV) by means of diantipyrils in the presence of large amounts of elements, which usually interfere with cerium determination, was demonstrated. A study was made of the absorption of the products of photochemical oxidation and of the absorption and stability in time of the products of oxidation with Ce(IV) salts of antipyrine and a number of its analogs. It was shown that diantipyrilphenylmethane and triantipyrilmethane interact with Ce(IV) salts in a molar ratio of 1:2 that confirms the structural formula for a dye formed on diantipyrilphenylmethane oxidation. On the basis of the data about the molar ratios in Ce reactions the molar extinction coefficients of the dyes formed on the oxidation of dimethylaminoantipyrine, diantipyrilphenylmethane, and triantipyrilmethane with Ce(IV) salts were calculated. Diantipyril-4-isopropylmethane, diantipyril-4-bromophenylmethane, diantipyril-2,4-dihydroxyphenylmethane, diantipyril-3,4-dihydroxyphenylmethane, diantipyrilfurilmethane, diantipyrilthiophenylmethane, diantipyrilethylenemethane, and 3,3'-diantipyril-1-phenylpropylene-1,2 were synthesized for the first time. (auth)

27305 EXTRACTION OF PLUTONIUM AND OTHER ELEMENTS WITH N-BENZOYLPHENYLHYDROXYLAMINE. M. K. Chmutova, O. M. Petrukhin, and Yu. A. Zolotov. Zh. Analit Khim., 18: 588-95(May 1963). (In Russian)

The extraction of a Pu(IV) compound with N-benzoylphenylhydroxylamine (BPHA) from nitric, hydrochloric, and sulfuric acid solutions was studied. It was shown that Pu is readily extracted with a 0.4 M reagent solution in chloroform from 1 to 6 M nitric acid solutions after a short-time contact of the organic and aqueous phases. Plutonium is sparingly extracted from hydrochloric and sulfuric acid solutions that was used for its back-extraction with hydrochloric and sulfuric acids. A study was made of the effect of the BPHA concentration, duration of the phase contact, and of certain foreign ions on Pu extraction from nitric acid solutions. The extraction of U(VI), Am, Np(V), and Np(IV), and fission products was studied under the optimum conditions for Pu separation. It was found that practically no extraction of U, Am, Np(V), and of the major part of the fission products takes place under the same conditions. Of the fission products (a year old) only Zr and Nb are extracted. A method was developed for the separation of Pu from U and the fission products. After the extraction with a 0.4 M BPHA solution from 3 M nitric acid Pu is back-extracted with sulfuric acid; by this it is separated from Zr and Nb and is determined radiometrically. The method may be used for separation of pairs: Pu–U and Pu–Am. (auth)

27306 A NEW EFFECTIVE METHOD FOR THE SEPARATION AND PURIFICATION OF PROTACTINIUM FOR ITS FOLLOWING RADIOMETRIC DETERMINATION. B. F. Myasoedov and E. S. Palshin (Vernadskii Inst. of Geochemistry and Analytical Chemistry, Moscow). Zh. Analit. Khim., 18: 596-602(May 1963). (In Russian)

A new method for the separation of Pa from U ores and waste products after their treatment was developed and is

based on Pa extraction from sulfuric acid solutions with isoamyl alcohol in the presence of arsenazo III. Protactinium is completely separated from macroamounts of Fe, Zr, U, Hf, and radioactive isotopes Po^{210}, Th^{230}, and Ac^{223} in a single cycle of purification. The method is simple and rapid. It ensures a good yield of Pa and permits its determination in natural samples by a radiometric method with the experimental error of 3 to 5%. (auth)

27307 EXTRACTION-PHOTOMETRIC DETERMINATION OF BORON IN URANIUM TETRAFLUORIDE. Z. K. Karalova and A. A. Nemodruk. Zh. Analit. Khim., 18: 615-17(May 1963). (In Russian)

An extraction-photometric method for B determination in UF_4 is described. The sample is decomposed by heating in a carbonate solution in the presence of H_2O_2, then B is extracted with dichloroethane as methylene blue tetrafluoroborate from a H_2SO_4 solution, and the optical density of the extract is measured. The sensitivity of the method is 8×10^{-5}%. The experimental error when amounts of 8×10^{-5} to 4×10^{-3}% of boron are determined is within ±5%. (auth)

27308 MASS-SPECTROGRAPHIC DETERMINATION OF MICROIMPURITIES IN SOLID SUBSTANCES. M. S. Chupakhin and G. G. Glavin (Vernadskii Inst. of Geochemistry and Analytical Chemistry, Moscow and State Scientific Research and Design Inst. of Rare Metal Industry, Moscow). Zh. Analit. Khim., 18: 618-23(May 1963). (In Russian)

Methods are described for deciphering mass spectra, recording microimpurities in pure substances, and for calculating their concentrations. Data are given on the sensitivity of the method and accuracy and reproducibility of the results. A method is suggested by which the impurities can be distinguished as uniformly distributed, introduced and irregularly distributed. The results are given on the study of the impurity content in Pt and Ag. The concentration of carbon polyatom molecules in graphite was determined and an attempt was made to connect their yield with the structure of the solid phase. (auth)

27309 USE OF ZONE MELTING FOR CONCENTRATING IMPURITIES IN SPECTROGRAPHIC ANALYSIS OF PURE BISMUTH. E. E. Konovalov, Sh. I. Peizulaev, G. P. Pinchuk, I. E. Larionova, and L. I. Kondrat'eva. Zh. Analit. Khim., 18: 624-33(May 1963). (In Russian)

Taking metallic Bi as an example, the possibility of using the zone melting method for concentrating impurities was demonstrated. The conditions for zone melting were found to ensure the qualitative concentration of traces of Ag, Cu, and Tl in metallic Bi with the concentration factor of 20 to 30. Two methods were developed for the spectrographic analysis of Bi for 18 elements (Ag, Cu, Tl, Cd, Te, Pb, Sn, Zn, In, Sb, Fe, Ni, Cr, Mn, Al, Mg, Ca, B): by the excitation of the spectrum of powdered metallic Bi in a d-c arc, and by the excitation of the spectrum of pressed metallic electrodes in a spark. From the above elements, Ag, Cu, and Tl are determined both in the concentrate and in the sample without concentration; all the other elements are determined only in the sample without concentration. All the 18 elements are determined together by a single spectrogram. The sensitivity of the method is 1×10^{-4} to 1×10^{-7}%. A method of preparing metallic standards (powdered and pressed) for all the above elements is given. (auth)

27310 IDENTIFYING PLANT AND ANIMAL DEFICIENCIES BY RADIOACTIVE MEANS. Warner W. Schultz (to General Electric Co.). U. S. Patent 3,094,621. June 18, 1963. Filed Apr. 24, 1959.

A method is given for determining element deficiencies, absorption, and distribution in plants. The method comprises radioactivating the plant, recording the gamma and beta spectra of the irradiated plant with a scintillation spectrometer, and analyzing the spectra to determine the elements. (D.L.C.)

Inorganic and Physical Chemistry

Refer also to abstracts 27968, 28082, and 28083.

27311 (AROD-2099.12) COVALENCY EFFECTS IN SPECTRA OF Pr^{3+} AND Nd^{3+} IN $LaCl_3$ AND $LaBr_3$. Technical Report No. 3. Isaac Richman (California. Univ., Los Angeles). Jan. 1963. 51p.

Two models are presented to explain the observed shifts of J levels which depend on the host lattice in which the spectrum is observed. It is shown that the crystalline field model cannot explain the observed shifts. The second model which takes into account the effect of covalent bonding can explain these shifts. Two different ions, Pr^{3+} and Nd^{3+}, were used to investigate this shift. In both cases the host lattices studied were $LaCl_3$ and $LaBr_3$. Using the covalent model the difference in amount of mixing between rare earth ion and ligands in the two crystals was determined. For both Pr^{3+} and Nd^{3+} the results were similar. There was approximately a 0.4% change in F_2. This change corresponds to 0.2% more mixing in $LaBr_3$ than in $LaCl_3$. In both cases the model was able to account for about 75% of the observed shift, which, considering the accuracy to which the J levels are known, is rather convincing evidence that the covalent model is correct and that covalency is the major cause of such shifts. (auth)

27312 (AROD-2099.13) LATTICE VIBRATION SPECTRA OF $LaCl_3$ AND $LaBr_3$. Technical Report No. 4. Isaac Richman (California. Univ., Los Angeles). Jan. 1963. 138p.

The vibronic satellites associates with electronic transitions of Pr^{3+} in $LaCl_3$, $LaBr_3$, $PrCl_3$, and $PrBr_3$ were studied. These satellites cannot be accounted for by pure electronic transitions. It was proposed that these satellites are due to transitions to states which are a combination of a lanthanide 4f electronic state and a crystalline vibrational state. The effect of the change of mass of both the anions and the cations is just what would be expected if this hypothesis were correct. The number of levels observed was also shown to be consistent with this hypothesis. A model was proposed based on this hypothesis, and using this model symmetry coordinates for the lattice vibrations were constructed. Selection rules from symmetry considerations and the model were calculated. The vibrational levels of the crystals obtained from the vibronic transitions were tabulated. A correlation between the vibrational levels in $LaCl_3$ and those in $LaBr_3$ was proposed. One possible scheme for assigning irreducible representations to the vibrational levels is given. (auth)

27313 (ASD-TDR-62-843) AN INVESTIGATION OF PHYSICAL PARAMETERS OF NON-ELECTRICALLY CONDUCTING FINE PARTICULATES. D. W. Koester, E. B. Cornelius, and J. J. Donovan (Houdry Process and Chemical Co., Linwood, Penna.). Aug. 24, 1962. Contract AF33(616)-8032. 43p.

Research is being conducted to find measurable properties of active ceramic powders, which can be related to sinterability. Samples of active magnesia were prepared by calcination of basic carbonate at 400 to 900°C and tested for activity in a closed system. The activity measurements, oxygen exchange and initial specific absorption

of CO_2, indicate that the bulk structure as well as the surface of such materials is extremely active. There are indications that these measurements can be used to characterize ceramic materials with respect to their sinterability. Data from decomposition experiments and CO_2 adsorption studies are discussed. The results emphasize the difficulties involved in preparing uniform, large-scale lots of activated powders, and the care required in their handling to avoid inadvertent contamination by adsorption of atmospheric constituents H_2O and CO_2. (auth)

27314 (BM-RI-6248) HIGH-TEMPERATURE HEAT CONTENTS AND ENTROPIES OF SESQUIOXIDES OF LUTETIUM, DYSPROSIUM, AND CERIUM. L. B. Pankratz and K. K. Kelley (Bureau of Mines. Berkeley Thermodynamics Lab., Berkeley, Calif.). Jan. 1963. 10p.

High-temperature heat-content values of pure Lu sesquioxide and Dy sesquioxide were measured over the temperature range from 298 to 1800°K. Similar data for Ce sesquioxide were calculated from measurements of a mixture of Ce sesquioxide and dioxide and known values for Ce dioxide. The results for Lu sesquioxide are regular. Dysprosium sesquioxide has a minor thermal anomaly near 1590°K, the extra heat absorption being 220 cal/mole. Hexagonal Ce sesquioxide undergoes a transformation around 1050°K, which is only slowly reversible; consequently results were obtained for both the low- and high-temperature varieties. The original heat-content data are reported, and smooth values of heat content and the corresponding entropy increments are tabulated. Equations were derived to represent the heat-content values. (auth)

27315 (LA-2841) HEATS OF DISSOCIATION OF GASEOUS CHLORIDES. R. C. Feber (Los Alamos Scientific Lab., N. Mex.). Jan. 1963. Contract W-7405-eng-36. 100p.

Available experimental data pertaining to the vaporization of chlorides of elements of the first long period of the periodic table and beyond are listed. Heats of formation and heats of dissociation of the gaseous chlorides at 298.15°K are calculated and in some cases estimated. Heats of atomization of selected elements are reviewed. 270 references are included. (P.C.H.)

27316 (LADC-5517) THE KINETICS OF THE REACTION BETWEEN Pu(VI) AND Fe(II). T. W. Newton and F. B. Baker (Los Alamos Scientific Lab., N. Mex.). [1962]. Contract [W-7405-eng-36]. 23p.

The kinetics of the reaction Pu(VI) + Fe(II) = Pu(V) + Fe(III) were studied in acid perchlorate solutions between 0 and 25°C. The rate is given by $-d[PuPVI)]/dt = [Pu(VI)][Fe(II)]\{A + (B + C[H^+])^{-1}\}$ from 0.05 to 2.0M $HClO_4$ at $\mu = 2.0$. This rate law indicates the presence of a metastable binuclear intermediate, probably Pu(V) · Fe(III). Values of ΔH^* and ΔS^* were computed for the formation of the three activated complexes required by the rate law. The effect of ionic strength between 0.05 and 2.0M and the effect of 0.10M Cl^- were determined. (auth)

27317 (NAA-SR-7918) DETERMINATION OF CARBON IN SODIUM BY ISOTOPE DILUTION MASS SPECTROMETRY. K. Y. Eng, C. D. Bingham, and R. A. Meyer (Atomics International. Div. of North American Aviation, Inc., Canoga Park, Calif.). June 30, 1963. Contract AT (11-1)-Gen-8. 23p.

A method utilizing isotope dilution mass spectrometry was developed for the determination of elemental carbon in sodium. In the range of 50 to 150 μg of carbon, precision and accuracy of ±10 to 25 μg were demonstrated. The determination is not affected by loss of generated carbon dioxide nor by contamination from any source except elemental carbon. (auth)

27318 (NAA-SR-8086) THE ELECTRICAL CONDUCTIVITIES OF MOLTEN BISMUTH–BISMUTH TRIIODIDE SOLUTIONS. L. F. Grantham and S. J. Yosim (Atomics International. Div. of North American Aviation, Inc., Canoga Park, Calif.). June 26, 1963. Contract AT(11-1)-Gen-8. 17p.

The electrical conductivities of $Bi-BiI_3$ solutions were measured above the consulute temperature over the entire composition range. The specific conductance increases continuously and monotonically with increasing metal composition; for example, at 500°C the increase is from 0.32 for pure BiI_3 to 7,170 $(ohm\text{-}cm)^{-1}$ for the metal. The temperature coefficients of the specific conductance are positive for all compositions except those greater than 80 mole % bismuth. Both a positive and negative temperature coefficient were observed at 80%. The results are discussed in terms of various mechanisms of conductance. (auth)

27319 (ORNL-TM-585) A STUDY OF THE POLYMERIZATION, DEPOLYMERIZATION, AND PRECIPITATION OF TETRAVALENT PLUTONIUM AS FUNCTIONS OF TEMPERATURE AND ACIDITY BY SPECTROPHOTOMETRIC METHODS: PRELIMINARY REPORT. D. A. Costanzo and R. E. Biggers (Oak Ridge National Lab., Tenn.). July 1, 1963. Contract W-7405-eng-26. 26p.

Studies were made on the kinetics of the polymerization of tetravalent Pu, depolymerization of polymeric Pu(IV), and properties of Pu(IV) polymer under representative solution conditions of acidity, temperature, and ion concentrations encountered in fuel processing. The polymerization of tetravalent Pu was studied as a function of the Pu concentration, (1 to 8 mg Pu/ml), nitric acid concentration, (0.03 to 0.3 M), and temperature (25 to 95°). Under these conditions, disproportionation and nitrate oxidation of the tetravalent Pu occurred and were also studied. It is clearly indicated that colloidal polymer formation is favored by an increase in the Pu concentration and temperature, or by a decrease in the acidity. Temperature had a pronounced effect on the rate and extent of polymer formation at any particular acidity. The effects of $UO_2(NO_3)_2$, $Al(NO_3)_3$, $NaNO_3$, and F^- upon the kinetics of polymer formation in acidic nitrate media were also determined at low acidities and elevated temperatures. In the presence of high concentrations of the nitrate salts the colloidal Pu(IV) polymer was observed to precipitate. The precipitation of aged colloidal Pu(IV) polymer by nitrate-containing electrolytes, HNO_3, $Al(NO_3)_3$, $NaNO_3$, and $LiNO_3$, was studied at 25°C. The Pu(IV) polymer was aged by refluxing for 24 hr at the boiling temperature. The amount of aged polymer precipitated reached a maximum at 2 to 3 M nitrate, and decreased thereafter with an increase in nitrate concentration. Precipitation did not occur above a nitrate concentration of 4 M. The depolymerization reaction kinetics of freshly prepared Pu(IV) polymer at fixed acidity were observed to be first order, depending only upon the concentration of Pu present as polymer. The results show that polymer formation and precipitation can be prevented by the proper control of solution conditions, and that polymer, once formed, can be depolymerized. (P.C.H.)

27320 (ORO-602) STUDY OF SEQUESTRATION OF METAL IONS IN BRINE USING RADIOISOTOPES. Final Report. George W. Reid and Robert N. Thompson (Oklahoma. Univ., Norman. Research Inst.). Dec. 1962. Contract AT(40-1)-2698. 54p. (OKLA-2698-2)

The sequestration of metal ions in synthetic and natural brines using radioisotope techniques was studied. The success of water flooding for secondary recovery of oil depends largely upon a readily available and abundant supply of suitable media. The petroleum industry often uses the large quantities of brines which are co-produced with the crude oil. Brines can be used for injection after they are conditioned to minimize corrosion of equipment and to prevent plugging of receiving sand formations. Below-ground treatment is a method used to avoid the considerable expense of coagulation, sedimentation, filtration, aeration, chemical treatment, and deaeration. It consists of introducing a sequestrant into raw brine prior to injection in order to complex specific metal ions such as calcium, magnesium, iron, and barium. Two methods using radioisotopes to evaluate the effectiveness of the sequestering agent ethylene diaminetetraacetic acid (EDTA) were investigated: a theoretical approach to chelation of a single cation (calcium) confirmed by laboratory tests on a synthetic brine, and a direct empirical approach using simultaneous "tags" of radioiron and radiocalcium on a natural oil field brine. In the first method it was shown that the degree of sequestration of calcium in a predominantly calcium synthetic brine could be measured by introducing an isotope of calcium into the brine, treating with varying concentrations of chelate, and counting the residual or complexed cation remaining in solution after precipitation of the unchelated fraction. The second method was developed in an attempt to establish a simplified direct approach to the determination of chelate stability. The use of two radioisotopes (Ca^{45} and Fe^{59}) made it necessary to devise a counting procedure appropriate to available equipment that would allow differentiation of sequestered calcium and sequestered iron. Samples of natural brine from a producing oil field were tagged with the two isotopes, treated with precipitant solutions of sodium carbonate, sodium sulfate, and sodium hydroxide, and subjected to varying concentrations of chelate. Stability of the sequestrant was evaluated by counting at appropriate time intervals the residue collected on membrane filters, an increase in counts being an indication of instability. No evidence of instability of the EDTA was observed during the 68-day test runs. (auth)

27321 (UCRL-7298-T) THE HEAT OF FORMATION OF XENON TETRAFLUORIDE. Stuart R. Gunn and Stanley M. Williamson (California. Univ., Livermore. Lawrence Radiation Lab.). Mar. 28, 1963. Contract W-7405-eng-48. 13p.

The heat of reaction of XeF_4 with aqueous iodide solution was measured. The standard heat of formation is −60 kcal/mol and the average thermochemical bond energy is 31 kcal. (auth)

27322 (UCRL-7301-T) HEATS OF EXPLOSION OF UNSTABLE GASEOUS HYDRIDES. Stuart R. Gunn (California. Univ., Livermore. Lawrence Radiation Lab.). [1962]. Contract [W-7405-eng-48]. 10p.

In continuation of earlier work on hydrides of Groups IV and V and boron, the heats of explosion of H_2Te, of mixtures of H_2Se with H_2Te, and of mixtures of Si_2H_6, Ge_2H_6, and $B_{10}H_{14}$ with SbH_3 were measured. The heats of formation of simple hydrides of Groups IV to VII in Periods 2 to 5 show quite regular trends. The average thermochemical M-M bond energies in Si_2H_6 and Ge_2H_6 are larger than those in Si_2H_6 and Ge_2H_6 by amounts similar to the difference between C_3H_8 and C_2H_6. A simple calorimeter for use with removable reaction cells and operable at elevated temperatures was constructed. (auth)

27323 (UCRL-7325-T) COMPARISON STANDARDS FOR SOLUTION CALORIMETRY. Stuart R. Gunn (California. Univ., Livermore. Lawrence Radiation Lab.). [1963]. Contract [W-7405-eng-48]. 11p.

Criteria for processes useful for the intercomparison of solution calorimeters are discussed. Measurements were made of the heats of four processes: dissolution of potassium chloride in water, dissolution of succinic acid in dilute hydrochloric acid, dissolution of magnesium metal in dilute hydrochloric acid, and neutralization of strong sulfuric acid in excess dilute sodium hydroxide. Effects of variations in treatment of the standard substance and in temperature and reagent concentrations were studied in some cases. It is concluded that the sulfuric acid-sodium hydroxide system is the most reproducible and should have the broadest utility. (auth)

27324 (UCRL-10620) THE ABSOLUTE INTENSITY OF C_2 SWAN BANDS (thesis). Lucy Gay Hagan (California. Univ., Berkeley. Lawrence Radiation Lab.). Mar. 18, 1963. Contract W-7405-eng-48. 117p.

The Swan-band system of the C_2 molecule was produced in emission in a source of thermal equilibrium. The ratio was measured of the intensity in emission and in absorption of certain features of the O-O Swan band relative to a blackbody or to a tungsten lamp by using photographic plates and photoelectric scanning techniques. The absolute intensity for the feature was obtained therefore, since the absolute intensity of a blackbody or of a tungsten lamp can be obtained from the Planck equation and the experimentally measured emissivity of tungsten. Experimental results are expressed in terms of the absolute f value or oscillator strength. The absolute f value for the O-O Swan band of C_2 in emission is 0.004 ± 0.0007 for the photoelectric scanning experiments on rotational lines, and 0.006 ± 0.004 for emission measurements of rotational lines on photographic plates. For emission experiments at the O-O head the f value is 0.007 ± 0.004. Absorption experiments at the O-O band head give an f value of 0.005 ± 0.003. The best value for the absolute oscillator strength or f value of the O-O band of C_2, obtained by averaging the f values from the emission and absorption data, is 0.005 ± 0.003. (auth)

27325 (AERE-Trans-942) THE STABILITY OF THE HOMOGENEOUS STRUCTURE OF FLUIDISED BEDS. E. Ruckenstein. Translated by R. Todd (U.K.A.E.A. Atomic Energy Research Establishment, Harwell, Berks, England) from Rev. Phys., Acad. Rep. Populaire Roumaine, 7: 137-43(1962). 10p.

The effects of particle distribution (homogeneous or heterogeneous) on physical or physico-chemical processes in fluidized beds are briefly discussed, and stability of the homogeneous structure of such a bed is defined. Equations of motion for particles in a fluid are derived, and the methods of Liapounoff are used to investigate the stability of a homogeneous structure. Results indicate that a homogeneous structure is more stable for fluidization with liquids than for fluidization with gases. (D.C.W.)

27326 EFFECT OF NITROGEN ON THE ISOTOPIC EXCHANGE REACTION BETWEEN HYDROGEN AND WATER VAPOR. E. Fodor, N. Marazan, V. Mercea, and A. Olariu (Inst. of Atomic Physics, Cluj and Babes-Bolyai Univ., Cluj). Acad. Rep. Populare Romine, Studii Cercetari Fiz., 14: 7-23(1963). (In Rumanian)

The modifications of the transport constant of the catalyzed isotopic exchange reaction between hydrogen and water vapor, occurring when the relative concentration of

reactants is altered, were studied by adding nitrogen, a gas that does not participate in the reaction, to the mixture. Data on the mechanism of the reaction were obtained by comparing the experimental values with the theoretical values of the transport constant. In order to deduce the theoretical values, the kinetic equations of the reaction were solved by assuming two possible cases for the reaction mechanism: a homogeneous reaction occurring in a single step and an oxidation-reduction type reaction occurring in two steps with the explicit participation of the catalyst. The results obtained have shown that neither of the two hypotheses is entirely satisfactory. With the second hypothesis, however, a more correct quantitative description of the phenomena was obtained. (tr-auth)

27327 NEW COMPOUNDS OF NOBLE GASES: THE FLUORIDES OF XENON AND RADON. Neil Bartlett (Univ. of British Columbia, Vancouver, Can.). Am. Scientist, 51: 114-18(Mar. 1963).

Synthesis of xenon di-, tetra-, and hexafluoride and radon difluoride is described and properties of the compounds are discussed. Radon difluoride was prepared by heating a radon–fluorine mixture to 400° for 30 min. It is much less volatile than its Xe analog, and has resistance to reduction by H, which occurs only above 200°. The hydrolytic behavior of Xe tetrafluoride points to the existence of hydrated oxides and possibly xenates. As members of what is Group VIII B of the periodic classification, Xe and Rn ought to have even-numbered valence states, and the established simple fluorides obey this rule. Presumably both Xe^{+} and Xe^{2+} are paramagnetic ions. (TCO)

27328 REVERSIBLE AND IRREVERSIBLE PROCESSES AT THE MERCURY ELECTRODE. XVII. PROMETHIUM(III). J. Sancho, J. Almagro, and V. Almagro. Anales Real Soc. Espan. Fis. Quim. (Madrid), Ser. B, 58: 811-12(Dec. 1962). (In Spanish)

Conclusions of poralographic interest about Pm^{3+} are showed in supporting solution of 1M LiCl–35% ethyl alcohol. The half-wave potential of the only wave found is –1.850 volt versus S. C. E. in such conditions. (auth)

27329 THE CRYSTAL STRUCTURE OF CERIUM(IV) ACETYLACETONATE. B. Matković (Institut "Rudjer Bošković," Zagreb) and D. Grdenić. Acta Cryst., 16: 456-61(June 10, 1963). (In English)

The atomic co-ordinates of cerium(IV) acetylacetonate were obtained by the heavy-atom method with the help of electron-density projections along [010] and [100] making use of the isomorphism to the analogous thorium compound. The co-ordination polyhedron of oxygen atoms around the cerium atom is a slightly distorted Archimedean antiprism, the Ce–O distance being 2.40 ± 0.03 Å and the O–Ce–O bond angle 72 ± 1°. The atoms of the acetylacetonate ring are coplanar. The mean values of the O···O distances within an acetylacetonate ring are 2.81 Å, and the distances between the adjacent rings are 2.95 and 2.97 Å along the edge of the triangular or square faces, respectively. (auth)

27330 INVESTIGATING THE MECHANISM OF CHEMICAL REACTIONS WITH THE AID OF STABLE AND RADIOACTIVE ISOTOPES. H. Schmied. Brown Boveri Rev., 49: 544-55(Nov.-Dec. 1962).

A discussion is presented of the methods of employing tracers, the synthesis of labelled substances, the isotope effect, and exchange reactions and their applications. Some typical examples are considered in which labelled substances are used. (auth)

27331 A. C. POLAROGRAPHY OF URANIUM IN NONCOMPLEXING AND COMPLEXING MEDIA. K. A. Khasgiwale, S. C. Saraiya, and A. K. Sundaram (Atomic Energy Establishment, Trombay, India). Bull. Chem. Soc. Japan, 36: 349-50(Mar. 1963). (In English)

Uranium gives two waves in acid noncomplexing media. The effects of salt concentration, frequency, and uranium concentration on the peak heights were measured. The effects of oxalic acid, ammonium thiocyanate, and lactic acid on the current were studied and explained. (D.L.C.)

27332 α-PICOLINE COMPLEXES OF THE THIOCYANATES OF ALKALINE-EARTH METALS. G. C. Bhattacharya and H. C. Dasgupta (Ranchi Univ., India). Indian J. Chem., 1: 152-5(Apr. 1963).

α-Picoline complexes of thiocyanates of calcium and strontium were prepared and their properties and composition determined. It is found that barium thiocyanate does not form any complex under the experimental conditions employed. The stability of calcium and strontium complexes was studied on the basis of heat of dissociation, pressure-composition isothermals, heat of formation, lattice energy of the complex, and entropy functions of the system. The results show that the stability of complex does not depend merely on the number of ligand molecules forming the complexes. (auth)

27333 SILVER LANTHANUM FERRITE—A NEW FERROMAGNETIC MATERIAL. K. K. Laroia and A. P. B. Sinha (National Chemical Lab., Poona, India). Indian J. Pure Appl. Phys., 1: No. 6, 215-19(June 1963).

A new ferromagnetic compound of chemical composition $Ag_{0.5}La_{0.5}Fe_{12}O_{19}$ was formed by solid state reaction between silver oxide, lanthanum oxide, and α-ferric oxide at temperatures 1100-1350°C. The crystal structure is isomorphous with that of magnetoplumbite. The unit cell is hexagonal with c = 22.85 Å, a = 5.85 Å, and c/a = 3.905 and contains two formula units of $Ag_{0.5}La_{0.5}Fe_{12}O_{19}$. The unoriented sample has the following magnetic properties: remanence, 1600 gauss; induction coercivity, 1100 oersteds; intrinsic coercivity, 2450 oersteds, and Curie temperature, 435°C. Heating the compound with bismuth oxide or aluminum oxide decomposes it to α-Fe_2O_3, free silver, and a double oxide of lanthanum and bismuth or aluminium, thus leading to a marked deterioration in its magnetic properties. (auth)

27334 MEAN AMPLITUDES OF VIBRATION AND THERMODYNAMIC FUNCTIONS OF TECHNETIUM HEXAFLUORIDE. G. Nagarajan (Annamalai Univ., Annamalainagar, India). Indian J. Pure Appl. Phys., 1: No. 6, 232-4 (June 1963).

The inactive fundamental frequency coming under the F_{2u} species of technetium hexafluoride was calculated from values of potential constants obtained with the other five observed fundamental frequencies of the same molecule and found to be 180.2 cm^{-1}. Numerical values of sixteen mean-square amplitude quantities were computed at the temperatures T = 0 and 298°K. The corresponding mean amplitudes of vibration for Tc-F and F and F distances were also reported at these temperatures. Using these observed fundamental frequencies, the molar thermodynamic functions were calculated on the basis of a rigid rotator, harmonic oscillator approximation at a pressure of 1 atm in the temperature range 100-2000°K. (auth)

27335 PHASE DIAGRAM OF THE SYSTEM $MgAl_2O_4$–$NdAlO_3$. N. A. Toropov and N. A. Sirazhiddinov. Izv. Akad. Nauk SSSR, Otd. Khim. Nauk, No. 2, 374-6(Feb. 1963).

The phase diagram of the system $MgAl_2O_4$–$NdAlO_3$ was studied. Specimens containing 0, 5, 10, and so on, mole %

of one component (2 mole % intervals in the vicinity of the eutectic) were prepared under argon from carefully mixed γ-Al_2O_3, MgO, and Nd_2O_3 in a high-temperature electric vacuum microfurnace with a tungsten heating element. After equilibrium was attained, the samples were hardened and subjected to crystallo-optical, metallographic, and x-ray analyses. The system forms no chemical compounds or solid solutions and is of the simple eutectic type, with the eutectic at 1835°C, 62 mole % $MgAl_2O_4$ and 38 mole % $NdAlO_3$. (OTS)

27336 PHASE EQUILIBRIA FOR THE TERNARY FUSED-SALT SYSTEM $NaF-BeF_2-UF_4$. J. F. Eichelberger, C. R. Hudgens, L. V. Jones, G. Pish, T. B. Rhinehammer, P. A. Tucker, and L. J. Wittenberg (Monsanto Research Corp., Miamisburg, Ohio). J. Am. Ceram. Soc., 46: 279-83(June 1963).

The phase equilibrium diagram for the ternary fused-salt system $NaF-BeF_2-UF_4$ was based on evidence from differential thermal analysis, polarized light microscopy, and x-ray examination of samples obtained from thermal-gradient quenching studies and from high-temperature filtration experiments. All the stable compounds in the binary systems $NaF-BeF_2$ and $NaF-UF_4$ displayed primary-phase fields in the ternary system, including a new subsolidus compound which was observed and tentatively assigned the formula $NaF \cdot 4UF_4$. No ternary compounds or solid solutions were observed. The following three eutectics were found in the ternary system: (1) 72.5 NaF, 17.0 BeF_2, and 0.5 mole % UF_4 at 486°C, (2) 56.0 NaF, 43.5 BeF_2, and 10.5 mole % UF_4 at 339°C, and (3) 43.5 NaF, 56.0 BeF_2, and 0.5 mole % UF_4 at 345°C. (auth)

27337 MECHANISM OF THE LOW-TEMPERATURE SCAVENGING OF METHYL-d_3 RADICALS BY NITRIC OXIDE. A. Maschke, B. S. Shapiro, and F. W. Lampe (Pennsylvania State Univ., University Park). J. Am. Chem. Soc., 85: 1876-8(June 20, 1963).

Evidence supporting the successive addition of methyl radicals to nitric oxide at room temperature is reported. Mixtures of azomethane-d_6 and nitric oxide were photolyzed at 3660 Å and room temperature. In the presence of 0.2 to 2% nitric oxide, products observed were: CD_3NO, as indicated by the initial rapid appearance of a peak at mass 48; $(CD_3)_2NOCD_3$, as indicated by the appearance of peaks at masses 66 and 84 that arise from the same molecular species and that are in the ratio expected from inspection of the mass spectral cracking pattern of $(CH_3)_2NOCH_3$; and C_2D_6. C_2D_6 is formed at an increasing rate that is in accord with the postulate that the continually decreasing CD_3NO is competing for CD_3 radicals. It was concluded that at 25°C and 12 mm pressure, nitric oxide is only 15 times more effective than nitrosomethane in scavenging methyl radicals. (P.C.H.)

27338 DISSOLUTION RATES OF URANIUM DIOXIDE SINTERED PELLETS IN NITRIC ACID SYSTEMS. R. F. Taylor, E. W. Sharratt, L. E. M. de Chazal, and D. H. Logsdail (Atomic Energy Research Establishment, Harwell, Berks, Eng.). J. Appl. Chem. (London), 13: 32-40(Jan. 1963).

The dissolution process for sintered UO_2 into HNO_3 falls into two regimes of behavior that depend on the overall transfer rate. The critical dissolution rate is approximately 8 mg cm^{-2} min^{-1}, its precise value depending upon the solvent composition. Below this critical value there is a large degree of chemical kinetic control, the dissolution rate being proportional to the cube of nitric acid concentration, the experimental activation energy being 15 kcal $mole^{-1}$. Above the critical value the process appears to be controlled by the diffusion of a nitric acid species as the transfer rate is directly proportional to acid concentration with an activation energy of about 4 kcal $mole^{-1}$. In addition, the reactor is autocatalyzed by the nitrite product so that forced convection can reduce rates by a factor of four times, and nitrite neutralizers can reduce them by a factor of one hundred times. To a first approximation the dissolution rate depends simply on the total nitrate concentration although polyvalent nitrates and, in particular, ferric nitrate, tend to accelerate the reaction. (Uranium Abstr., Vol. 2, No. 4, May 1962)

27339 REDUCTION OF URANYL CARBONATE TO URANIUM DIOXIDE WITH FORMALDEHYDE SULPHOXYLATES. I. H. Warren and M. J. Finlayson (Univ. of British Columbia, Vancouver). J. Appl. Chem. (London), 13: 101-7(Mar. 1963).

Uranyl carbonate may be reduced to UO_2 with formaldehyde sulfoxylates (preferably the ammonium salt) or a mixture of formaldehyde and a bisulfite. The mechanism of the reaction is discussed. (Uranium Abstr., Vol. 2, No. 4, May 1963)

27340 CATHODIC ACTION OF THE METAL COMPLEXES AT THE DROPPING MERCURY ELECTRODE. VI. URANYL-PARA-METHYLAMINOPHENOL SULFATE COMPLEX. Tsai-teh Lai and Bi-cheng Wang (Cheng Kung Univ., Tainan, Taiwan, China). J. Chinese Chem. Soc. (Taiwan), 9: 14-25(Mar. 1962).

The complex formation of uranyl ion with p-methylaminophenol sulfate (Metol) was studied polarographically over the pH range 1.5 to 4.7. By comparing the polarogram of acidic uranyl perchlorate solution with that of uranyl perchlorate in Metol solution it was found that the half-wave potential of the first wave of U(VI) was shifted to the negative side by the addition of Metol, indicating complex formation by uranyl ion with Metol. The half-wave potential also changed with the change of pH value of the polarographic solution, thus it may be presumed that hydrogen ion or hydroxyl ion is involved in the cathodic reduction. A 1-electron, reversible reduction wave was observed in the pH range. At pH higher than 4.7, a reduction wave of complexing agent was noted. The diffusion current is proportional to the concentration of uranyl ion from 2.0×10^{-4}M to 5.1×10^{-3}M. The diffusion current constant was found to be 1.54 ± 0.03, and the diffusion coefficient $(7.96 \pm 0.2) \times 10^{-6}$ cm^2/sec. Two hydrogen ions, in the pH range of 1.5 to 2.1, and one hydrogen ion, in the pH range of 3.4 to 4.7, were consumed, respectively, by the reduction of 3 uranyl ions. At pH 2.6 to 4.7, U(V) had one ligand less than U(VI). (H.H.D.)

27341 INTERPRETATION OF KNUDSEN VAPOR-PRESSURE MEASUREMENTS ON POROUS SOLIDS. Gerd M. Rosenblatt (Univ. of California, Berkeley). J. Electrochem. Soc., 110: 563-9(June 1963). (UCRL-10619)

A simple steady-state model is used to describe the vaporization, in a Knudsen cell, of a porous solid having a low vaporization coefficient. The description is in terms of the effective vaporizing area of the solid. The nature of the effective area and the assumptions in the model are investigated. Procedures to obtain the equilibrium pressure and vaporization coefficient from pressures measured by varying the cell and sample geometry are discussed. A one-parameter, empirical equation is presented which accurately represents measurements of the vapor pressure of porous arsenic taken over a large range of Knudsen-cell orifice areas. (auth)

27342 FIELD-INDUCED LUMINESCENCE OF POWDERED PHOSPHORS. F. C. Palilla and M. Rinkevics (General Telephone and Electronics Labs., Inc., Bayside, N. Y.). J. Electrochem. Soc., 110: 750-3(July 1963).

Luminescence was observed in a variety of materials under the action of a-c and d-c fields. The materials include rare earth tungstates, Al_2O_3, and ZnO which were self-activated or activated with Cr, Mn, or a rare-earth element. Experiments in reduced pressures of a variety of atmospheres indicated that the luminescence observed is not the same as the electroluminescence of ZnS or of ZnO phosphors. This was further confirmed by differences in the frequency dependence of emission and by the analysis of the spectral components of the emission. Speculations as to the mechanism of the possible emission processes are discussed. (auth)

27343 MICROHARDNESS OF SINGLE CRYSTALS OF BeO AND OTHER WURTZITE COMPOUNDS. Carl F. Cline and J. S. Kahn (Univ. of California, Livermore). J. Electrochem. Soc., 110: 773-5(July 1963). (UCRL-6922)

The microhardness of single crystals of BeO, ZnS, AlN, CdS, ZnO, and CdSe was measured as a function of crystallographic orientation and the results correlated with bond distance, melting point, and band gap. (auth)

27344 REACTIONS BETWEEN REFRACTORY OXIDES AND GRAPHITE. K. L. Komarek, A. Coucoulas, and N. Klinger (New York Univ., New York). J. Electrochem. Soc., 110: 783-91(July 1963).

Reactions of alumina, magnesia, spinel, and beryllia with graphite were studied in vacuum by measuring the amount of carbon monoxide formed. Two types of reactions were observed: a diffusion-controlled reaction with alumina, beryllia, and thoria, and a phase boundary-controlled reaction with magnesia, beryllia, spinel, and titania. The following activation energies were obtained: 316 kcal for Al_2O_3, 40 kcal for BeO below 1700°C (parabolic rate law), 61.3 kcal for BeO above 1700°C (linear rate law), 59.8 kcal for MgO, 59.5 kcal for spinel, and 59 kcal for TiO_2. The relative reactivities of these oxides with graphite increased in the following order: BeO, spinel, MgO, ThO_2, Al_2O_3, TiO_2. For the reactions following a linear rate law a mechanism is proposed. It was concluded that the reaction proceeds over the gas phase by dissociation of the oxide into atomic oxygen and that the desorption of carbon monoxide from the graphite surface is the rate-determining step. (auth)

27345 TRANSFERENCE NUMBERS IN PURE MOLTEN SODIUM NITRATE. Roger J. Labrie and Vernon A. Lamb (National Bureau of Standards, Washington, D. C.). J. Electrochem. Soc., 110: 810-14(July 1963).

Transference numbers of the ions of pure molten sodium nitrate were measured in cells equipped with legs of sodium-ion conductive porcelain in the form of cylindrical membranes. The membranes served as sodium "electrodes" for selectively introducing sodium ions into the anode compartment and removing them from the cathode compartment of the cell during passage of current. Porous diaphragms of Pyrex, porcelain, and alundum were used to separate the anode and cathode compartments of the cell. (auth)

27346 TUNGSTEN, TITANIUM, AND TANTALUM CARBIDES AND TITANIUM NITRIDES AS ELECTRODES IN REDOX SYSTEMS. F. Mazza and S. Trassatti (Univ. of Milan). J. Electrochem. Soc., 110: 847-9(July 1963).

An electrochemical study was made of the behavior of tungsten, tantalum, and titanium carbides and of titanium nitride obtained by high-temperature cementation. Polarization curves were obtained for the electrodes in different solutions and under prolonged hydrogen or oxygen discharge on their surfaces in acid solutions. The tungsten carbide electrodes were found to be superior for studies in acid solutions at potentials below that required for oxygen evolution. They cannot be used in alkaline solutions, however, since they then corrode rapidly. Titanium nitride electrodes behave similarly for intermediate potentials. (M.C.G.)

27347 KINETICS OF THE REACTION OF HYDROGEN WITH ZIRCONIUM-TITANIUM ALLOY. V. Y. Labaton, S. G. Donn, R. H. Watson, and E. Whitehead (United Kingdom Atomic Energy Authority, Capenhurst, Chester, Eng.). J. Inorg. Nucl. Chem., 25: 641-56(June 1963).

The rate of reaction between zirconium–titanium alloys, containing 50 and 55 atomic per cent zirconium and hydrogen, was studied under static and flow conditions. It was shown that under most conditions studied the reaction is first order. The effect of surface state and of impurities in the hydrogen on the reaction was investigated. For comparable static and flow experiments at 550°C the reaction rates determined were 2×10^{-6} g/cm^2 min mmHg and 0.5×10^{-6} g/cm^2 min mm Hg, respectively. The calculated activation energies for the reaction are 4.1 kcal/mole between 400 and 520°C, and 15.7 kcal/mole between 520 and 600°C. A brief comparative study with unalloyed zirconium showed the reaction to be first order and gave an activation energy of 17.3 kcal/mole between 400 and 470°C. (auth)

27348 ON THE VOLATILITY OF SOME POLONIUM COMPOUNDS. H. Mabuchi (Tokyo Univ.). J. Inorg. Nucl. Chem., 25: 657-60(June 1963).

The volatility of thirteen polonium compounds that are extractable with organic solvents was investigated. The result of heating tests showed that all compounds resulting from the interaction of polonium with chelating agents volatilize below 200°C/1 atm. (auth)

27349 STEAM DISTILLATION OF POLONIUM COMPOUND WITH DIPHENYLCARBAZIDE. H. Mabuchi (Tokyo Univ.). J. Inorg. Nucl. Chem., 25: 661-5(June 1963).

Trace amounts of polonium can readily be steam distilled from 0.1 to 0.5 N nitric acid as the diphenylcarbazide complex. Chloride ion lowers the efficiency of the process. The separation is suitable for isolating Po from radium-D-E-F mixtures. (auth)

27350 INVESTIGATION OF THE CHEMISTRY OF PENTAVALENT NEPTUNIUM. Yu. A. Zolotov and I. P. Alimarin (Vernadskii Inst. of Geochemistry and Analytical Chemistry, Moscow). J. Inorg. Nucl. Chem., 25: 691-6 (June 1963).

The formation of complex compounds of Np(V) in solutions of oxalic, tartaric, citric, and ethylenediaminetetraacetic acids was investigated by an ion exchange procedure Several complexes were shown to exist and their composition and stability constants determined. A qualitative spectrometric study shows Np(V) forms complexes with some other substances. The ability of the NpO_2^+ ion to form complexes appears to exceed that expected for a large singly charged cation. The extraction of Np(V) chelates with thenoyltrifluoroacetone, acetylacetone, 1-nitroso-2-naphthol, cupferron, and 8-hydroxyquinoline was studied. Chelates of Np(V) with TTA and 1-nitroso-2-naphthol were shown to be readily extracted by pH 7-10 by solutions of the reagents in active oxygen-containing solvents, especially in n-butyl and other alcohols. The nature of the solvent markedly affects the extraction. The properties of NpO_2^+

were compared with those of the ions of other pentavalent actinides and an analogy between Np(V) and Am(V) and between U(V) and Pu(V) noted. (auth)

27351 A STUDY OF SORPTION OF ZIRCONYL PHOSPHATE AND CHANGES OF ITS PROPERTIES AT HIGHER TEMPERATURES. V. Veselý and V. Pekárek (Inst. of Nuclear Research, Czechoslovak Academy of Sciences, Rez). J. Inorg. Nucl. Chem., 25: 697-709(June 1963).

A method of chromatographic separation of zirconium from phosphate anion on an anion exchanger was developed for the analysis of zirconyl phosphate. The ratios P/Zr in zirconyl phosphates prepared under different conditions of precipitation were determined. The sorption of some 1 to 4 valent cations was investigated on different types of zirconyl phosphates heated to various temperatures. By measuring the infrared absorption spectra, the condensation of acid phosphate groups was demonstrated. (auth)

27352 X-RAY DIFFRACTION DATA ON HYDRATED URANIUM PEROXIDE. P. C. Debets (Reactor Centrum Nederland, Petten Netherlands). J. Inorg. Nucl. Chem., 25: 727-30(June 1963).

The x-ray diffraction patterns of hydrated uranium peroxide were obtained using CuK α radiation of 1.5418 Å. The cell dimensions for six samples were calculated. The cell volume was 240 ± 1 Å^3 containing two formula units. The symmetry was orthorhombic body centered. (C.E.S.)

27353 ANALYSIS OF THE THIRD SPECTRUM OF PRASEODYMIUM. Jack Sugar (Johns Hopkins Univ., Baltimore). J. Opt. Soc. Am., 53: 831-9(July 1963).

The spectrum of doubly ionized praseodymium was recorded and analyzed, with the result that 118 energy levels of odd parity and 130 levels of even parity were derived. These include nearly all the levels of the $4f^3$, $4f^25d$, $4f^26s$, and $4f^26p$ configurations as well as some low levels of the $4f5d^2$ and $4f^26d$ configurations. Electrostatic and spin-orbit parameters were determined for the $4f^26s$ configuration. From the hfs of the $4f^26s$ levels, a magnetic dipole interaction constant of 0.46 cm^{-1} was obtained. An ionization potential of 23.2 v was calculated from levels of the $4f^25d$ and $4f^26d$ series. (auth)

27354 INFLUENCE OF CRYSTAL SURFACE ON THE OPTICAL TRANSMISSION OF LITHIUM FLUORIDE IN THE VACUUM-ULTRAVIOLET SPECTRUM. D. A. Patterson and W. H. Vaughan (Naval Research Lab., Washington, D. C.). J. Opt. Soc. Am., 53: 851-5(July 1963).

A selective decrease in the spectral transmittance of cleaved LiF crystals at wavelengths shorter than 1600 Å was observed when they are exposed to the atmosphere. The decrease is attributed to a surface layer produced on the crystals by reaction with moisture. It can be substantially inhibited by immediate post-cleavage storage in dry gas or in vacuum. Optical-quality thin plates of currently available, commerical hard-to-cleave LiF that is softer than LiF previously manufactured can be obtained by first hardening the crystal with x rays, cleaving the plates, and then thermally annealing out the optical effects of the x rays. (auth)

27355 REFRACTIVE INDICES OF EVAPORATED CERIUM DIOXIDE–CERIUM FLUORIDE FILMS. Shiro Fujiwara (Japan Optical Industry Co., Ltd., Tokyo). J. Opt. Soc. Am., 53: 880(July 1963).

A mixture of cerium dioxide and cerium fluoride was evaporated simultaneously without marked fractional distillation, in spite of the great difference in their melting points. Thin films with continuously varying refractive indices ranging from 1.60 to 2.13 were prepared. Refractive indices of CeO_2–CeF_3 films were measured as a function of the mixing ratio. (C.E.S.)

27356 THE DECOMPOSITION PRESSURE AND MELTING POINT OF URANIUM MONONITRIDE. W. M. Olson and R. N. R. Mulford (Los Alamos Scientific Lab., N. Mex.). J. Phys. Chem., 67: 952-3(1963). (LADC-5527)

The decomposition pressure of UN was determined in the range 2500 to 2850°C by observing the apparent melting point as a function of N_2 pressure. The congruent melting point was found to be 2850 + 30°C at a N_2 pressure of ≥2.5 atm. An empirical equation was fitted to the data so that its curve asymptotically approaches the calculated $\Delta F°$ line as the temperature decreases: $\log p\ (atm) = 8.193 - (29.54 \times 10^3)1/T + (5.57 \times 10^{-18})T^5$. It is believed that the solubility of N_2 in U at its melting point is very small. (D.L.C.)

27357 THERMODYNAMIC PROPERTIES OF CALCIUM HYDRIDE. R. W. Curtis and Premo Chiotti (Ames Lab., Ames, Iowa). J. Phys. Chem., 67: 1061-5(1963). (IS-556).

The equilibrium hydrogen pressure over a system consisting of calcium and calcium hydride was measured in the temperature range 600 to 900°. The data below 780° can be represented by $\log P(atm) = -9610/T + 7.346$ and that above 780° by $\log P(atm) = -8890/T + 6.660$. The change in slope at 780° is to be expected on the basis of a solid state transformation existing in calcium hydride. The hydrogen dissociation pressures for the temperature range 600 to 780° were combined with known thermodynamic data for calcium along with known data on the calcium–hydrogen system to give the following thermodynamic relations: $\Delta F°_{CaH_2} = -42{,}278 + 31.52T$ (440 to 780°) and $\Delta F°_{CaH_2} = -41{,}410 + 24.78T + 1.93T \log T$ (25 to 440°). (auth)

27358 SIGNIFICANCE OF BOND LENGTHS DETERMINED BY ELECTRON DIFFRACTION. L. S. Bartell and Kozo Kuchitsu (Ames Lab., Ames, Iowa). J. Phys. Soc. Japan, 17: Suppl. B-II, 20-2(1962). (IS-563)

The derivation of structural parameters of known absolute significance, as mean and equilibrium bond lengths, from experimental electron diffraction patterns is discussed. A series of diatomic molecules was investigated to test the theoretical interpretation of diffraction patterns, and, at the same time, to test the precision of the latest techniques of electron diffraction. Preliminary least squares results for bond lengths and amplitudes of vibration for the molecules O_2, NO, N_2, and Cl_2, analyzed as Morse anharmonic oscillators, are reported. Standard errors range from 0.0008 to 0.003 Å. The results, when corrected for vibrational effects, are found to agree with spectroscopic results to within experimental error. A brief discussion is given of the possible utility of the accuracy now attainable in structure determinations. (auth)

27359 LOW FREQUENCY HYDROGEN VIBRATIONS IN KH_2PO_4. Yoshihisa Wakuta (Kyushu Univ., Fukuoka). J. Phys. Soc. Japan, 18: 672-9(May 1963). (In English)

The low frequency motions of hydrogen in KH_2PO_4 and KD_2PO_4 at room temperature and below the ferroelectric Curie temperature were investigated. The energy interval covered ($8 \sim 170 \times 10^{-3}$ ev) corresponds to wave numbers of $25 \sim 1300$ cm^{-1}, a region that is difficult to be investigated by infrared absorption technique. The excitation modes associated with hydrogen are identified by the change in scattering intensity upon deuteration. It is found that a band of frequencies centered around 180 cm^{-1} is associated with the hydrogen vibrations. A comparison with Reid's semi-empirical theory for KH_2PO_4 is made. (auth)

27360 AUTOMATIC COMPUTATION OF ELECTRONIC ENERGIES OF DIATOMIC MOLECULES. Tadashi Arai (Carnegie Inst. of Tech., Pittsburgh). J. Phys. Soc. Japan, 18: 718-32(May 1963). (In English)

A general method for computing electronic energies and wave functions of diatomic molecules is described and arranged in such a way that the processes of the computation are carried through systematically and fully automatically by an electronic computor. The number of electrons in the molecule concerned, values of the nuclear charges, and symmetry properties of the molecule are the necessary informations. Symmetry adapted basic functions made up from molecular orbitals are automatically generated and the energy matrix involving them is calculated by using representation matrices of permutation groups. (auth)

27361 ABSORPTION BANDS OF CARBON DIOXIDE FROM 5.3 TO 4.6 MICRONS. Arthur G. Maki, Earle K. Plyler, and Robert J. Thibault. J. Res. Natl. Bur. Std., 67A: 219-23(May-June 1963).

Measurements were made of the frequencies of the infrared absorption lines of CO_2 in the region from 1850 cm^{-1} to 2150 cm^{-1}. Observations were made at various pressures and pathlengths up to a maximum of 72 meter-atmospheres. Vibration-rotation constants were obtained characterizing the transitions $11^{1c}0-000$, $11^{1d}0-000$, $03^{1c}0-000$, $03^{1d}0-000$, $200-01^{1c}0$, $12^{2c}0-01^{1c}0$, $12^{2d}0-01^{1d}0$ for $C^{12}O_2$. The $11^{1c}0-000$ band due to the $C^{13}O_2$ molecule was also measured. (auth)

27362 INFRARED SPECTRUM OF THE $\nu_2 + \nu_g$ BAND OF $C^{13}C^{12}H_6$. Walter J. Lafferty and Earle K. Plyler. J. Res. Natl. Bur. Std., 67A: 225-7(May-June 1963).

The infrared spectrum of the $\nu_2 + \nu_8$ band of $C^{13}C^{12}H_6$ was analyzed and a value of $B_0 = 0.64865 \pm 0.00005$ cm^{-1} determined. When this value is combined with that found in recent work on isotopically normal ethane, a r_s value of 1.527 ± 0.004 Å for the carbon-carbon bond distance is obtained. (auth)

27363 ADSORPTION OF P^{32} BY STRONTIUM SULPHATE AND LEAD SULPHATE FROM AQUEOUS SOLUTIONS CONTAINING TRACES OF FERRIC IRON. K. R. Kar and M. M. Bhutani (Univ. of Delhi). J. Sci. Ind. Res. (India), 21B: 280-1(June 1962). (In English)

The adsorption of P^{32} by $PbSO_4$ or $SrSO_4$ in solutions containing more than 0.45 mM/l was studied. The results indicated that with $SrSO_4$ over 97% of P^{32} in the presence of 0.45 mM Fe^{3+}/l (pH = 2) could be obtained, but was dropped to 89% when the Fe^{3+} concentration was doubled. Similarly, 85% recovery was decreased to 72% in using $PbSO_4$. Low pH values decrease the Fe^{3+} interference in the solution. (TCO)

27364 DETERMINATION OF URANIUM OXIDE FORMATION HEATS BY MEANS OF DYNAMIC DIFFERENCE CALORIMETRY. H. Scheibe and W. Ermischer (Zentralinstitut fllr Kernphysik, Rossendorf, Ger.). Kernenergie, 6: 178-80(Apr. 1963). (In German)

The dynamic difference calorimeter served in a modified differential thermoanalytical method for the determination of the intermediate phases which originate in the oxidation of UO_2. The heats of formation of U_3O_7 and U_3O_{12} were found to be -11.3 ± 1.2 and -3.3 ± 0.5 kcal/mol, respectively. (M.C.G.)

27365 NUCLEAR RESONANCE SPECTRA OF ELECTROLYTE SOLUTIONS. R. E. Richards and B. A. Yorke (Physical Chemistry Lab., Oxford). Mol. Phys., 6: 289-300(Apr. 1963).

Bromine-79, bromine-81, and sodium-23 resonances are reported for solutions of bromides in aqueous and non-aqueous solvents. The results indicate that quadrupole coupling at the nuclei of Br^- and Na^+ in solutions of sodium and of calcium bromide arises from ion-solvent interactions, and not ion–ion interactions. In the case of cesium bromide solutions, ion–ion interactions are important. (auth)

27366 IMPROVED ONE-CENTRE WAVE FUNCTIONS FOR THE HYDROGEN AND METHANE MOLECULES. D. M. Bishop (Carnegie Inst. of Tech., Pittsburgh). Mol. Phys., 6: 305-15(Apr. 1963).

Corrections are made to the Joy–Parr hydrogen and the Saturno–Parr methane one-center wave functions and the functions are accurately reminimized with respect to the energy. The electronic wave functions and total molecular energies are obtained for various internuclear distances and the equilibrium internuclear distance and the breathing force constant determined. Three methods for calculating the force constant are given and compared. The equilibrium bond length for hydrogen is found to be 1.38 Å and the force constant 6.33 md/Å. For methane the equilibrium C–H distance is found to be 2.014 Å and the force constant 25.8 md/Å. The total computed molecular energies for the equilibrium configurations of hydrogen and methane are −1.1605 Å and −39.8444 Å respectively. (auth)

27367 SEMI-CLASSICAL APPROXIMATION TO DENSITY OF VIBRATIONAL ENERGY LEVELS. P. C. Haarhoff (University Chemical Lab., Cambridge, Eng.). Mol. Phys., 6: 337-9(Apr. 1963).

An expression for the level density for n harmonic oscillators at energies where the semi-classical level density is a fair approximation is provided. The density of vibrational energy levels is given for $CHCl_3$, CH_3Cl, C_3H_6, and C_3D_6. (C.E.S.)

27368 MEASUREMENT AND THEORETICAL DETERMINATION OF THE THERMAL CONDUCTIVITY OF GOOD-CONDUCTING POWDERS. M. von Kiss (Eidgenössische Technische Hochschule, Würenlingen, Ger.). Neue Tech., 5: 247-56(May 1963). (In German)

An investigation was carried out to find an electrically insulating powder of high thermal conductivity, which could be used as insulator in a high current heating element. Measurements were made on several types of Al_2O_3 as well as on MgO and other granular solids. The influence of density, particle size, etc., on thermal conductivity was studied. These results, together with data from the literature, showed that previously published equations predicted low values of thermal conductivity. An equation of dimensionless form was obtained which gives a good fit of the thermal conductivity data of solids in different gases. (auth)

27369 SOLVENT EXTRACTION SEPARATION OF SCANDIUM FROM YTTRIUM AND RARE EARTH ELEMENTS. Tsunenobu Shigematsu (Kyoto Univ.), Masayuki Tabushi, Masakazu Matsui, Yasuharu Nishikawa, and Shiro Goda. Nippon Kagaku Zasshi, 84: 263-7(Mar. 1963). (In Japanese)

The solvent extraction separation of Sc from Y and rare earths with acetylacetone or dibenzoylmethane was studied. In order to find out a convenient method, the above methods were compared with conventional thiocyanate method and TTA method. The extractability was determined radiometrically, using radioactive isotopes, Sc^{46}, Y^{91}, $Eu^{152,154}$, and Lu^{177} as tracers. The last two elements were selected as the representatives of rare earths. The extraction recoveries of scandium obtained under each optimum condition are given. From the results it was revealed that both the acetylacetone- and dibenzoylmethane-benzene (or

chloroform) systems are as useful as the TTA-benzene system. Among them the extraction with acetylacetone or TTA is convenient as far as the separation of Sc from Y and rare earths is concerned. However TTA is better than acetylacetone, because the extraction can be performed at lower pH region. (P.C.H.)

27370 MEASUREMENT OF THE OSCILLATOR STRENGTH OF THE RESONANCE LINE OF CALCIUM BY THE ABSORPTION METHOD IN AN ATOMIC BEAM. A. I. Odintsov. Opt. Spectry. (USSR) (English Transl.), 14: 172-6(Mar. 1963).

The oscillator strength of the resonance line Ca I 4227 Å was determined from measurements of the line absorption profile in an atomic beam. The concentration of atoms in the beam was determined from the rate of condensation of atoms on the collector plate. The weight of condensed calcium was measured by spectral analysis. The value obtained ($f_{4227} = 1.6 \pm 0.1$) is in agreement with measurements. (auth)

27371 EXCITATION OF ATOMIC SPECTRA IN THE REACTION ZONE OF THE ACETYLENE AIR FLAME. V. F. Zhitkevich, A. I. Lyutyi, N. A. Nesterko, V. S. Rossikhin, and I. L. Tsikora. Opt. Spectry. (USSR) (English Transl.), 14: 180-2(Mar. 1963).

The anomalous excitation of 25 elements in the inner cone of an air-acetylene flame was investigated. The ratio of line intensities in the inner and outer cones was studied as a function of excitation energy. It is shown that anomalous excitation appears at energies of 4 ev or higher. Possible practical applications of anomalous excitation are suggested. (auth)

27372 ABSORPTION AND LUMINESCENCE OF DIVALENT SAMARIUM IN ALKALI-HALIDE SINGLE CRYSTALS. V. E. Karapetyan, B. I. Maksakov, and P. P. Feofilov. Opt. Spectry. (USSR) (English Transl.), 14: 236-7 (Mar. 1963).

Single crystals of MeHal (Me = Na, K; Hal = Cl, Br, I), activated with ~0.05% (by weight) of $SmCl_3$, were grown. The absorption of grown crystals were characteristic of divalent Sm ions and consist of a number of intense wide bands in the visible and ultraviolet regions of the spectrum. When the crystals were cooled to 77°K, the bands were noticeably narrowed, but no fine structure could be observed that was similar to that of MeF_2-Sm^{2+}. (P.C.H.)

27373 DIRECT MEASUREMENTS OF RECOMBINATION RATES IN A SHOCK TUBE. T. A. Jacobs, R. A. Hartunian, R. R. Giedt, and R. Wilkins (Aerospace Corp., El Segundo, Calif.). Phys. Fluids, 6: 972-4(July 1963).

By an extension of the ideas embodied in the single-pulse shock tube, a technique was developed that allows the direct measurement of recombination rates of many atomic species at high temperature. The expansion chamber is located a few tube diameters from the shock tube end plate rather than at the high-pressure end as in the conventional single-pulse shock tube. A cylindrical diaphragm, lying flush with the inside diameter of the tube, is used to control the time of initiation of an expansion wave. Experimental observation showed that the technique increases the gas expansion rate by an order of magnitude in comparison with the conventional single-pulse shock tube. The one-dimensionality of the flow at the shock tube end wall was also investigated. The technique developed, in conjunction with the spectroscopic means of observation, was employed to gain preliminary measurements of the recombination rate of atomic chlorine. (auth)

27374 CALCULATION OF THE DETONATION PROPERTIES OF CONDENSED EXPLOSIVES. Wildon Fickett (Los Alamos Scientific Lab., N. Mex.). Phys. Fluids, 6: 997-1006(July 1963).

The Chapman–Jouguet detonation velocity and thermodynamic state variables are calculated for a representative set of CHON explosives, using the Lennard–Jones and Devonshire cell theory equation of state together with a modified conformal solution treatment of the mixture problem, and allowing for chemical equilibrium among nine product species. Although fair agreement with experiment can be obtained by adjusting a single parameter of the pair potentials, the results are little better than those obtainable with much simpler theories. (auth)

27375 LOCALIZED MODE DETECTION BY MEANS OF THE MÖSSBAUER EFFECT. Alvin D. Dinhofer (Univ. of Maryland, College Park). Phys. Rev., 131: 535-9(July 15, 1963).

The Mössbauer effect in a simple cubic crystal, disordered by light isotopes was studied for the possibility of observing the localized mode vibrational spectrum over the background of the continuum. (auth)

27376 STRUCTURE OF THE F CENTER IN NaF. William T. Doyle (Dartmouth Coll., Hanover, N. H.). Phys. Rev., 131: 555-62(July 15, 1963).

The electron-nuclear double resonance (ENDOR) method is applied to the study of the structure of the F center in NaF. Hyperfine interactions between the F-center electron and a number of the surrounding nuclear shells are presented and compared with the results of earlier experiments and with theory. It is found that the resolved hyperfine structure is not due to the predominance of the first-shell interaction, as was thought, but it arises from the fortuitous equality of the first- and second-shell isotropic hyperfine interactions. Electron paramagnetic resonance (EPR) absorption measurements of the resolved structure confirms an expected 31-line resolved pattern. The exceptional resolution found in the ENDOR spectrum permits the identification of interactions with nuclei well beyond the eighth shell. Although the samples also contained large numbers of M centers, no evidence for a paramagnetic M center was found in either the EPR or ENDOR spectra. (auth)

27377 ROLE OF CRYSTAL STRUCTURE IN THE F-CENTER SPECTRUM OF CESIUM HALIDES. F. Martino (Massachusetts Inst. of Tech., Cambridge). Phys. Rev., 131: 605-7(July 15, 1963).

Spectral positions of the F centers of cesium halides are computed by applying a purely geometry-dependent theory, the point-ion-lattice approximation of Gourary and Adrian. Results are compared with those previously obtained in alkali halides with NaCl structure. Although theoretical results coincide well with the Mollwo-Ivey relation regardless of type of crystal structure, experiments show large deviations from this relation in certain cases. Since the point-ion-lattice approximation does not predict these deviations, it is concluded that within this approximation difference of geometry alone has insignificant effect on spectral positions of F centers in the alkali halides, and that the point-ion-lattice method is not sufficient for their computation. (auth)

27378 STARK EFFECT AND HYPERFINE STRUCTURE OF HYDROGEN FLUORIDE. Rainer Weiss (Massachusetts Inst. of Tech., Cambridge and Tufts Univ., Medford, Mass.). Phys. Rev., 131: 659-65(July 15, 1963).

The nuclear hyperfine structure constants and the electric dipole moment of hydrogen fluoride, H^1F^{19}, in the ground-vibration and first excited rotation state were measured in a molecular beam electric resonance exper-

iment. The hfs constants are: $c_F = 307.6 \pm 1.5$ kc, $c_p = -70.6 \pm 1.3$ kc, $\frac{2}{5}g_p g_F \mu_{nm}^2/h\langle r^3\rangle = 57.6 \pm 0.44$ kc. The apparatus was calibrated by observing Stark transitions in the ground-vibration and first excited rotation state of carbonyl sulfide, $O^{16}C^{12}S^{32}$, that gave $\mu_{HF}/\mu_{OCS} = 2.554 \pm 0.0037$, or $\mu_{HF} = 1.8195 \pm 0.0026$ D, by using $\mu_{OCS} = 0.7124 \pm 0.0002$ D. An absolute measurement of the OCS electric dipole moment gave $\mu_{OCS} = 0.7120 \pm 0.003$ D. A digitally computed solution of the Stark effect with magnetic hyperfine structure was necessary to interpret the data. The theory and experiment are in good agreement over the range of electric-field strengths used in the experiment. The hfs constants are in excellent agreement with the averaged absolute values of these constants as measured in a molecular beam magnetic resonance experiment. The agreement has significance because of discrepancies between the results from the two resonance methods, for some other molecules, in previous experiments. (auth)

27379 THE IONIC PRODUCT OF DEUTERIUM OXIDE AND ITS MIXTURES WITH PROTIUM OXIDE. V. Gold and B. M. Lowe (King's Coll., London). Proc. Chem. Soc., 140-1(May 1963).

The ionic product of H_2O-D_2O mixtures was measured for atom fractions of deuterium ranging from 0 to 1.0. The data are compared on a graph with theoretical predictions based on three alternative models. The results support the formula H_3O^+ for the hydrogen ion, although the agreement could be improved by assuming four equivalent hydrogen atoms in the hydroxide ion. (D.L.C.)

27380 THE FRACTIONATION OF HYDROGEN ISOTOPES BETWEEN HYDROGEN IONS AND WATER. V. Gold (Brookhaven National Lab., Upton, N. Y.). Proc. Chem. Soc., 141-3(May 1963). (BNL-6839)

The fractionation effect was measured by proton magnetic resonance measurements on isotopically mixed acid solutions. The results yield a value of 0.69 ± 0.02 for the equilibrium constant $K = \lambda'\mu/\lambda\mu'$, where λ = atom fraction of protons in the hydrogen ions, μ = atom fraction of protons in water molecules, and λ' and μ' are the analogous atom fractions for deuterium nuclei in hydrogen ions and water molecules. (D.L.C.)

27381 NEUTRON DIFFRACTION STUDIES OF THE ACTINIDE OXIDES. I. URANIUM DIOXIDE AND THORIUM DIOXIDE AT ROOM TEMPERATURE. B. T. M. Willis (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Proc. Roy. Soc. (London), Ser. A, 274: 122-33(June 25, 1963).

Three-dimensional neutron structure factors were measured on single crystals grown from the melt and from solution. The Bragg reflections divide into three groups, strong, medium and weak: the strong and medium reflections are affected by extinction, which is particularly severe for solution-grown crystals, and the weak reflections by double Bragg scattering. Least-squares analysis of experimental data corrected for these systematic errors confirms that the oxides have the fluorite structure at room temperature and gives precise values for the Debye–Waller factors of the heavy-metal and oxygen atoms and for the ratios of their nuclear coherent scattering amplitudes. (auth)

27382 NEUTRON DIFFRACTION STUDIES OF THE ACTINIDE OXIDES. II. THERMAL MOTIONS OF THE ATOMS IN URANIUM DIOXIDE AND THORIUM DIOXIDE BETWEEN ROOM TEMPERATURE AND 1100°C. B. T. M. Willis (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Proc. Roy. Soc. (London), Ser. A, 274: 134-44(June 25, 1963).

The mean-square thermal displacements of the atoms in UO_2 and ThO_2 were determined as a function of temperature from the analysis of two-dimensional diffraction data. In the range investigated, 20 to 1100°C, the oxygen atoms vibrate more strongly than the metal atoms and at each temperature the displacements of the metal and oxygen atoms are slightly less in ThO_2 than in UO_2. The interpretation of these results gives a Debye characteristic temperature that is independent of temperature above 400°C and equal to 377°K for UO_2 and 393°K for ThO_2. As the temperature rises, the oxygen atoms tend to be displaced from the fluorite-type sites at $(\frac{1}{4}\ \frac{1}{4}\ \frac{1}{4})$ ... towards the large interstitial holes at $(\frac{1}{2}\ \frac{1}{2}\ \frac{1}{2})$ .... At 1000°C the mean atomic co-ordinates of the oxygen atoms are $\frac{1}{4} + \delta\frac{1}{4} + \delta\frac{1}{4} + \delta$ ... , where $\delta = 0.016$ for UO_2 and $\delta = 0.014$ for ThO_2. This relaxation effect indicates either that the oxygens are disordered or that they vibrate anharmonically across the $(\frac{1}{4}\ \frac{1}{4}\ \frac{1}{4})$ ... positions. (auth)

27383 FERROMAGNETIC URANIUM MONOSULFIDE. Wlodzimierz Trzebiatowski and Wojciech Suski (Inst. of Physical Chemistry, Polish Academy of Sciences, Wroclaw). Roczniki Chem., 37: 117-18(1963).

A study was made of the magnetic properties of uranium monosulfide, US, obtained from a stoichiometric mixture of S and U, the latter being produced by thermal decomposition of uranium hydride. The mixture was compressed and placed in a Be crucible and introduced into a silica tube. The tube was evacuated, sealed, and heated at 900 to 1000°C for 7 days. The tubes were opened in a dry box in an Ar atmosphere; their content was transferred to a W crucible and heated at 2200°C for 5 min in a vacuum. The US thus produced is a gray powder, with a rock salt structure and a lattice constant $\underline{a} = 5.489$ Å. Magnetic measurements were performed by the Faraday method at temperatures within the limits 90 to 293°K, at a field intensity up to 8480 Oe. At low temperatures US is ferromagnetic with a Curie point of 185°K. Above 185°K the magnetic susceptibility conforms to the Curie-Weiss law. The paramagnetic moment calculated from the equation $M = 2.83\sqrt{M\chi_g(T-\Theta)}$ equals 2.22 BM and is lower than that for UTe and USe (2.84 and 2.51 BM, respectively). The susceptibility per mole at room temperature after introducing corrections for the diamagnetism of U^{4+} and $S^{=}$ equals 5773×10^{-6}. (TCO)

27384 THE CATALYTIC DEUTERIUM EXCHANGE REACTION OF BENZENE AND ITS DERIVATIVES WITH DEUTERIUM OXIDE BY Ni POWDERS. Kozo Hirota, Tomiko Ueda, Keiji Kuwata, and Motoyosi Hatada (Osaka Univ.). Shokubai (Tokyo), 2: No. 2, 181-8(1960). (In Japanese)

Hydrogen isotope exchange reactions between D_2O and three aromatic hydrocarbons, benzene, p-xylene, and ethylbenzene, were studied spectroscopically using a specially designed glass vacuum apparatus to react the aromatic hydrocarbons with D_2O in the presence of Ni powder catalysts, prepared by the decomposition of Ni-formate. The distribution of D in the reacted samples was determined by the mass spectrometer, and the reaction products were identified by infrared spectroscope and nuclear paramagnetic resonance. It was found that in the presence of Ni catalyst the H atoms in the side chain of p-xylene and ethyl benzene were able to exchange easily with the D atom in D_2O. However, considerable difficulty was observed in the case of the H atom exchange of the aromatic rings of these compounds as well as of benzene. This difference of hydrogen isotope exchangeability is explained by assum-

ing a special adsorption state of these aromatic compounds on the Ni catalyst. (TTT)

27385 DEUTERIUM ISOTOPE EFFECT IN AMMONIA SYNTHESIS. Atumu Ozaki (Tokyo Inst. of Tech.). Shokubai (Tokyo), 2: No. 2, 223-9(1960). (In Japanese)

Reaction kinetics between nitrogen, H_2 and D_2, were studied in order to clarify the reaction mechanism of the catalytic ammonia synthesis. Mixtures consisting of $0.25N_2 + 0.75H_2$, and $0.25N_2 + 0.75D_2$, were reacted in a continuous-flow type chemical reactor, with two types of Fe catalysts, 0.27% K_2O – 0.85% Al_2O_3 – remainder Fe, and 1.6% K_2O – Al_2O_3 – remainder Fe. The reaction rate was measured as a function of flow velocity of reacting gas at the temperature range from 218°C to 302°C. A reaction rate equation was derived from the experimental data. It was found that N reacts about four times faster with D than with H. These results cannot be explained by the generally accepted Temkin's theory which postulates that the rate-determining step of the ammonia synthesis is the dissociation of the N_2 molecule. It must be assumed that the main adsorbed substance on the catalysts is the NH radical. (TTT)

27386 CATALYZED EXCHANGE REACTION BETWEEN AMMONIA AND DEUTERIUM IN THE PRESENCE OF EVAPORATED NICKEL FILM. Koshiro Miyahara and Akiko Tsumura (Hokkaido Univ., Sapporo). Shokubai (Tokyo), 3: No. 2, 118-22(1961). (In Japanese)

The relative importance of the elementary steps in the successive hydrogen isotope exchange reaction between NH_3 and D_2, $NH_3 \rightarrow NH_2D \rightarrow NHD_2 \rightarrow ND_3$ and $D_2 \rightarrow HD \rightarrow H_2$ were determined by reaction rate measurements and by reaction kinetics analysis. The gaseous mixture of NH_3 and D_2 was reacted in the presence of the evaporated Ni film catalyst at 100 and 120°C, and the rate of concentration change of the components was followed mass spectrometrically. A set of rate equations was derived for expressing the absolute rate of each elementary reaction, including dissociation steps of the reacting species. It was concluded that the slowest elementary reaction is $NH \rightarrow N + H$ and that the overall rate of increasing of deuterium content in hydrogen gas is controlled by the dissociation reaction of hydrogen molecule; $H_2 \rightarrow 2H$. The activation energies of each elementary reaction are also given. (TTT)

27387 THE CATALYTIC DEUTERIUM EXCHANGE REACTION OF p-XYLENE AND ANISOLE WITH DEUTERIUM OXIDE ON METALLIC CATALYST. Tomiko Ueda and Kozo Hirota (Osaka Univ.). Shokubai (Tokyo), 3: No. 2, 122-6(1961). (In Japanese)

Kinetics and spectroscopic studies on the hydrogen isotope exchange reaction between D_2O and p-xylene or anisole were conducted for clarifying the reaction mechanism. These aromatic hydrocarbons were reacted with D_2O for about 150 to 300 hrs in the presence of each of five kinds of catalysts, Pt, Pd, Ni, Ni–SiO_2, and Ni–Al_2O_3, at temperatures between 80 and 100°C. The mass spectrometric, infrared spectroscopic, and nuclear paramagnetic resonance methods were used to measure the rate of reaction and to identify the chemical species in the reaction products. It was found that there is a marked difference in the catalytic ability for the exchange reaction of hydrogen atoms in the aromatic ring with D_2O. Pt, Pd, and Ni–Al_2O_3 catalysts could easily promote this exchange reaction but Ni and Ni–SiO_2 catalysts could not. To the contrary, all of these catalysts could promote the exchange reaction of side chain. These differences are attributed to the different adsorption states of the aromatic compounds on these catalysts. (TTT)

27388 CATALYSTS ON THE ENRICHMENT OF HEAVY WATER BY MEANS OF EXCHANGE REACTION. Saburo Enomoto and Hiroaki Ugajin (Utsunomiya Univ., Japan). Shokubai (Tokyo), 3: No. 2, 126-30(1961). (In Japanese)

As a screening test for finding a practical catalyst for the dual exchange process of heavy water production, the catalytic activities of about 50 metal-metal, metal-oxide, oxide-oxide type catalyst were compared. The rate of the reaction, $H_2O + HD \rightleftharpoons HDO + H_2$, was measured in the presence of these catalysts at 80 and 300°C, using the gas-phase reactor operated at ordinary pressures and the liquid-phase reactor operated at high pressures. The results of these experiments indicated that the Ni–Cr_2O_3 type materials are the most active and most economical catalysts, having nearly the same catalytic activities as the Pt–C catalyst. The durability of Ni–Cr_2O_3 can be greatly improved by addition of 30 weight % of silica gel. Ni–MnO and KSY–FA (stabilized nickel catalyst) were also found to be useful. (TTT)

27389 THE CATALYTIC HYDROGENATION AND DEUTERIUM EXCHANGE REACTION WITH H_2, D_2 AND D_2O OF TOLUENE ON Ni AND Pt CATALYSTS. Atsumu Ozaki, Fumio Nozaki, Yoshihiro Kawasaki, and Kiyoshi Morikawa (Tokyo Inst. of Tech.). Shokubai (Tokyo), 3: No. 2, 138-44(1961). (In Japanese)

Kinetics and infrared spectroscopic studies on the D-H exchange reaction between D_2 or D_2O and benzene or toluene were conducted in order to clarify the reaction mechanism of catalytic hydrogenation of these compounds. The rate of reaction between these substances was measured by using a continuous flow type chemical reactor; the infrared spectroscopic analysis of the reaction products served to determine the location of the exchange reaction. The most marked difference was noted in the catalytic abilities of Pt and Ni catalysts, for the D-H exchange reaction in aromatic rings. Pt catalyst can easily stimulate the exchange of hydrogen atom both in aromatic rings and side chains but Ni catalysts can promote the exchange reaction only in the side chains. These effects are attributed to differences in the adsorption states of the aromatic compounds on these catalysts. (TTT)

27390 CATALYTIC ISOTOPIC EXCHANGE REACTION BETWEEN PROPENE AND DEUTERIUM OXIDE ON NICKEL CATALYSTS. Kozo Hirota and Yoshie Hironaka (Osaka Univ.). Shokubai (Tokyo), 4: No. 1, 41-6(1962). (In Japanese)

Reaction kinetics and spectroscopic studies of hydrogen isotope exchange reaction between propene and D_2O were conducted in order to clarify the reaction mechanism of catalytic hydrogenation of olefinic hydrocarbon. Propene and D_2O were reacted at 38°C in the presence of Ni catalysts which were or were not supported on silica gel or alumina, using the analysis of the reaction products. The mass spectrometric, infrared spectroscopic, and nuclear paramagnetic resonance methods were used to determine the reaction rate and the location of hydrogen exchange. When the unsupported Ni catalysts were used, the main reaction products were propene $1-d_1$, propene $1-2-d_2$, and cis-propene $1-2-d_2$; no exchange reaction in the methyl groups was observed. With supported Ni catalysts, the exchange reaction took place also in the methyl groups. These differences in the catalytic behavior are attributed to the different adsorption states of propene on the various catalysts. (TTT)

27391 STRUCTURE OF THE ELECTRON ENERGY SPECTRUM IN Th_3P_4-TYPE CRYSTALS. G. F. Karavaev, N. V. Kudryavtseva, and V. A. Chaldyshev (Tomsk Poly-

technic Inst., USSR). Soviet Phys.-Solid State (English Transl.), 4: 2540-9(June 1963).

The topological structure of the electron energy spectrum in the Th_3P_4-type crystals is investigated by the weighted corepresentations method, and the laws governing dispersion in the vicinity of the symmetrical points of the Brillouin zone are derived. (auth)

27392 CALCULATION OF STRUCTURE FACTORS FOR THE INELASTIC SCATTERING OF SLOW NEUTRONS IN NaCl-TYPE CRYSTALS. Z. A. Demidenko (Semiconductor Inst., Academy of Sciences, Kiev). Soviet Phys.-Solid State (English Transl.), 4: 2459-64(June 1963).

On the basis of the previously calculated amplitudes of natural vibrations in a number of alkali–halide crystals (NaCl, KCl, KBr, NaI, LiF), structure factors are calculated for the neutron scattering in three directions of the wave vector q, namely, [0, 0, 1], [1, 1, 0], and [1, 1, 1]. The behavior of the structure factors of the enumerated crystals is compared and an approximate method of plotting crystal parameters and values of the vibration amplitudes for q = 0 is proposed. (auth)

27393 DIPOLE STRUCTURE AND INTERNAL ELECTRIC FIELDS IN $PbZrO_3$. V. N. Lyubimov, Yu. N. Venevtsev, S. P. Solov'ev, G. S. Zhdanov, and A. B. Bakushinskii (Karpov Inst. of Physics and Chemistry, Moscow). Soviet Phys.-Solid State (English Transl.), 4: 2594-9(June 1963).

The most probable values of internal electric fields and induced electronic dipoles in $PbZrO_3$–a crystal having peculiar electrical properties–calculated by using a point dipole structure model are considered. The effect of the charges and polarizabilities of the ions, as well as that of the unit-cell volume, is analyzed. (auth)

27394 URANIUM SOLUBILITY IN LIQUID GALLIUM, INDIUM, THALLIUM AND LEAD. Irving Johnson and Martin G. Chasanov (Argonne National Lab., Ill.). Trans. Am. Soc. Metals, 56: 272-7(June 1963). (TID-17616; UAC-7004)

The solubility of uranium in liquid gallium, indium, thallium, and lead was determined by sampling the saturated solutions. The solubilities are expressed by the empirical equations: in Ga (420 to 649°C), log (at. % U) = 3.571 – 3823 T^{-1}; in In (455 to 720°C), log (at. % U) = 3.781 – 5146 T^{-1}; in Tl (400 to 854°C), log (at. % U) = 4.184 – 5728 T^{-1}; and in Pb (416 to 802°C), log (at. % U) = 3.921 – 5121 T^{-1}. (auth)

27395 ESR- AND ENDOR- SPECTRA OF F CENTERS IN RbCl AND RbBr. H. Seidel and H. C. Wolf (Technische Hochschule, Stuttgart). Z. Physik, 173: 455-61(1963). (In German)

ESR (electron spin resonance) and ENDOR (electron-nuclear double resonance) spectra of F centers in RbCl and RbBr were measured, giving the hyperfine constants for 5 or 6 shells of neighboring ions. The resolved structure with a characteristic distance of 36 G in the ESR spectrum of RbCl is due to the interaction with the nearest Rb^{85} nuclei. All results fit well with the properties of F centers in other alkali halides. (auth)

27396 ISOTOPIC SHIFT OF SPECTRAL LINES. F. A. Babushkin. Zh. Eksperim. i Teor. Fiz., 44: 1661-7(May 1963). (In Russian)

A formula for the isotopic shift constant is derived, by applying the Sommerfeld method for determining wave functions and taking into account the finite size of nuclei. The calculations are carried out for two charge distributions in the nucleus, viz. homogeneous and trapezoidal ones. On the basis of a comparison of the experimental and theoretical values, two empirical parameters are introduced that characterize the nuclear compressibility; they are the regular compressibility coefficient $\eta = 0.7$, and the deformation compressibility coefficient $\xi = -\frac{5}{8}\pi$. These values yield agreement with most isotopes whose deformation parameters are known. (auth)

27397 KINETICS OF ELECTROCHEMICAL PROCESSES ON OXIDIZED ELECTRODES. II. THE FREQUENCY DEPENDENCE OF AN OXIDIZED ZIRCONIUM ELECTRODE IN OXIDATION-REDUCTION MEDIA. N. G. Bardina and P. D. Lukovtsev (Inst. of Electrochemistry, Academy of Sciences, USSR). Zh. Fiz. Khim., 37: 1008-14(May 1963). (In Russian)

The frequency dependence of the capacitance and resistance of an oxidized Zr electrode in the oxidation-reduction media Fe^{2+}/Fe^{3+} and $Fe(CN)_6^{4-}/Fe(CN)_6^{3-}$ was determined. The results were compared with Young's equations derived for the frequency dependence of capacitance and resistance of an electrode coated with an oxide film, assuming the presence of a space charge in the film and drop in potential on passing from the oxide-electrode boundary to the bulk of the oxide. Young's equations were shown in general to be in accord with the experimental data obtained for the Zr electrode, deviations being observed in $Fe(CN)_6^{4-}/Fe(CN)_6^{3-}$ solutions in the low frequency region. A qualitative explanation was given of the deviation on accounting for the impedance of the electrochemical reaction taking place at the oxide-electrolyte interface. The specific resistance of the film layer contiguous to the electrolyte was calculated and it was found to diminish with decrease in potential of the oxidation-reduction medium. (auth)

27398 RADIOCHEMICAL AND ELECTROCHEMICAL STUDIES OF ELECTRODE PROCESSES ON AMALGAMS. [PART] II. G. M Budov and V. V. Losev (Inst. of Electrochemistry and Inst. of Physics and Chemistry, Academy of Sciences, USSR). Zh. Fiz. Khim., 37: 1023-8(May 1963). (In Russian)

A method of studying the kinetics of electrode reaction on amalgam electrodes, based on combination of electrochemical and radiochemical measurements is described. A study was made of the electrode processes on zinc amalgam in solutions of zinc sulfate. Exchange currents were determined as function of amalgam and solution concentrations and of temperature. The transfer coefficients of anodic and cathodic processes were determined to be $\beta = 1.40 \pm 0.05$ and $\alpha = 0.52 \pm 0.04$ and the apparent activation energies to be 7.4 kcal/mole for the discharge-ionization stage and 5 kcal/mole for the diffusion limited stage. (auth)

27399 PHOTOCHEMICAL BEHAVIOR OF URANIN IN LIQUID AND SOLID SOLUTIONS. M. A. Avetisyan, V. S. Adamov, L. T. Kantardzhyan, and S. S. Chirkinyan (Inst. of Radiophysics and Electronics, Academy of Sciences, Armenian SSR). Zh. Fiz. Khim., 37: 1069-75(May 1963). (In Russian)

The absorption and luminescence spectra of liquid and solid solutions of uranin subjected to intense irradiation by unfiltered light from a mercury lamp were investigated. The solutions were of varying pH values. The existence of different photochemical processes was established. In a phosphorus-sugar solution of pH ca. 3.35 the photochemical process takes a considerably different course from that of the other solutions investigated, the former being characterized by strong increase in luminescence. The photoproduct formed in glycerol and in phosphorus sugar solutions of pH ca. 4, responsible for the appearance of a band ($\lambda \sim 470$ mμ) in the luminescence spectrum, was identified as uranin cation. (auth)

27400 RUTENII I OSMII; BIBLIOGRAFICHESKII UKAZATEL' LITERATURY, 1804-1960. (Ruthenium and Osmium; Bibliographic Guide to Literature (1804-1960)). A. A. Goryunov, Comp. Moscow, Publishing House of the Academy of Sciences, 1962. 252p.

References to books, brochures, articles, patents, and other materials giving information on the elements ruthenium and osmium are presented. The bibliography covers the period from 1804–1960. (C.E.S.)

27401 RAZDELENIE BLIZKIKH PO SVOISTVAM REDKIKH METALLOV [DOKLADY KONFERENTSII]. (Separation of Similar Rare Metals [Reports of the Conference, Moscow, Nov. 15-18, 1960]). Moscow, Metallurgizdat, 1962. 264p.

Methods for the separation of zirconium and hafnium, tantalum, niobium, and titanium, similar rare earth metals, tungsten and molybdenum, indium and tin, selenium and tellurium, cobalt and nickel, and similar alkaline earth metals are presented. The methods include fractional crystallization and precipitation, fractional distillation of volatile halogens, ion exchange, and selective reduction or oxidation agents. Twenty-six papers were presented. (C.E.S.)

27402 THERMODYNAMIC AND TRANSPORT PROPERTIES OF GASEOUS CO_2 (Engineering Materials). (General Dynamics Corp. Electric Boat Div., Groton, Conn.). 13 charts. (CAPE-956)

Gaseous CO_2 was investigated as a possible coolant and working fluid in a closed-cycle, gas-cooled, nuclear power plant. The thermodynamic properties of the gas at high temperatures were extrapolated. The entropies are given in the temperature range of 0 to 1500°F, and in the saturated region. The enthalpy-entropy (h-s) for CO_2 is given using different parameters such as compressibility factor, specific heat at constant pressure, velocity of sound, etc. (F.E.S.)

27403 PREPARATION OF URANIUM COMPOUNDS. Michel Bourgeois and Pierre Faugeras (to Commissariat à l'Énergie Atomique). British Patent 927,735. June 6, 1963. Priority date Aug. 3, 1960, France.

Treatment of Mo–U alloys at an initial temperature of 100 to 300°C with a gaseous mixture of a hydrogen halide and molecular oxygen gives uranium oxide or a mixture of uranium oxyfluoride and uranium tetrafluoride that is/are substantially free from Mo. Hydriodic hydrobromic, hydrochloric, or hydrofluoric acids can be used as the hydrogen halide; and subsequent fluoridization and distillation of the product will give substantially pure uranium hexafluoride. (D.C.W.)

Organic Chemistry

27404 (NAA-SR-Memo-7426) AN EVALUATION OF CONDENSED POLYCYCLIC COOLANT. M. A. Rotheram (Atomics International. Div. of North American Aviation, Inc., Canoga Park, Calif.). May 20, 1963. Contract AT-11-1-GEN-8. 32p.

Condensed Polycyclic Coolant is a low-cost refinery product which was evaluated as a potential moderator coolant for organic reactors. The radiolytic and pyrolytic decomposition rates of this candidate coolant were measured at 650 and 750°F; the coolant make-up rates and costs were calculated for the use of this coolant in a typical organic reactor (50 Mw(e) POPR), at several assumed operating temperatures in the range, 650-750°F. Comparison of make-up costs for this coolant and terphenyl coolant indicates that lower make-up costs will result from the use of Condensed Polycyclic Coolant in reactors operating with average out-of-core coolant temperatures below approximately 700°F. This comparison is based on differences in decomposition rates and price only; when such factors as the larger waste gas system required for Condensed Polycyclic Coolant, the greater amount of polymer disposal, etc., are considered, the make-up cost reductions resulting from the use of this coolant appear to be marginal even for reactors operating at temperatures below 700°F. In view of efforts to improve the plant efficiency of organic reactors by operating at higher coolant temperatures, further development work on this coolant is not warranted. (auth)

27405 (NLCO-882) REMOVAL OF FOREIGN ORGANIC MATERIALS FROM TBP–KEROSENE SOLVENT. N. R. Leist and J. H. Krekeler (National Lead Co. of Ohio, Cincinnati). June 25, 1963. Contract AT(30-1)-1156. 29p.

Three major sources of organic contamination of the tri-n-butyl (TBP)–kerosene solvent that was used in an ore refinery extraction system were identified. Two of the tramp materials, lubricating oils used in the extraction system and organic materials present in the incoming feed concentrates, can build up rapidly in the TBP–kerosene system and quickly render the solvent unsuitable for uranium extraction in the pulse column system. The third source of contamination was the nitration of the kerosene in the solvent. The foreign organic materials can be detected qualitatively and to some extent quantitatively through coalescence time testing and a light transmittance test of the solvent. A nitric acid saturation — charcoal adsorption treatment was developed to remove the tramp materials from the TBP–kerosene solvent and rehabilitate the solvent for uranium extraction purposes. A plant solvent treatment system process was designed and installed in the ore refinery. (auth)

27406 (RRL-113) ESR STUDIES OF ENERGY TRANSFER IN ETHANE–ETHYLENE MIXTURES. Richard W. Fessenden and Robert H. Schuler (Mellon Inst., Radiation Research Labs., Pittsburgh). June 6, 1963. Contract AT (30-1)-2310. 16p.

ESR methods were used to examine details of ethyl and vinyl radical production in radiation chemical studies of the ethane-ethylene, ethane-deuteroethylene and deuteroethane-ethylene systems. ESR measurements provide a very direct means of investigating the relative ratio of decomposition of each of the two components. In general ethylene is found to decompose to a considerably greater extent than expected from the composition of the system. The production of vinyl radicals from ethylene can be described in terms of a simple competition by ethylene and ethane for the energy deposited in the system. Ethylene is ~10 times more effective than ethane in this competition. This study shows that 55% of the ethyl radicals observed in pure ethane are produced directly and 45% by reactions of hydrogen atoms. (auth)

27407 BEHAVIOR OF DIALKYL PHOSPHORODITHIOIC ACIDS IN LIQUID EXTRACTION SYSTEMS. Raquel H. Zucal (Univ. of Tennessee, Knoxville), John A. Dean, and Thomas H. Handley. Anal. Chem., 35: 988-91 (July 1963).

The solubility and acidity of the diethyl, diisopropyl, di-n-butyl, and diisobutyl esters of phosphorodithioic acid in water and the distribution of each between CCl_4, methyl isobutyl ketone, or n-amyl acetate and HCl-NaCl solutions were studied. From the data, the acid dissocia-

tion constants and the partition coefficients were calculated. No evidence was found for dimerization of dialkyl phosphorodithoic acids in the organic phase. These constants are discussed, together with data for the dialkyl phosphates. The acid dissociation constant is somewhat larger and the partition coefficient is much larger when comparing di-n-butyl phosphorodithioic acid with di-n-butyl phosphate. (auth)

27408 DI-n-BUTYL PHOSPHOROTHIOIC ACID AS AN EXTRACTANT FOR METAL IONS. Thomas H. Handley (Oak Ridge National Lab., Tenn.). Anal. Chem., 35: 991-5 (July 1963).

Di-n-butyl phosphorothioic acid (5 w./v. % in CCl_4) was evaluated as a reagent for extracting metal ions from aqueous solutions of HCl or H_2SO_4. The results are presented in two periodic table type charts as plots of log distribution ratio (D) vs. log $[H^+]$. Of 32 metal ions studied, 18 extracted in significant amounts. In general, metal ions that form insoluble sulfides have the highest D. The relative order of extraction of 11 metal di-n-butyl phosphorothioate complexes was determined. The effect of di-n-butyl phosphorothioic acid concentration on the D values for Ag^+, Hg^{2+}, Zn^{2+}, and In^{3+} was investigated. The influence of various organic solvents on the D values for Hg^{2+} and Zn^{2+} was studied. The limits of extraction for Ag^+, Hg^{2+}, and Pd^{2+} were in the parts per billion range. The nature of the zinc di-n-butyl phosphorothioate complex was investigated. (auth)

27409 THE NATURE OF THE CONDENSED HYDROCARBONS FORMED BY HYDROLYSIS OF MIXTURES OF THE MONO AND DICARBIDE OF URANIUM. Bruno Blanchard, Pierre Blum, Ayme Cornu, and Jean Spitz (Centre d'Etudes Nucleaires, Grenoble, France). Compt. Rend., 256: 4227-9(May 13, 1963). (In French)

Hydrolysis in acid or neutral medium of the mixture $UC-UC_2$ leads to condensed products, composed exclusively of hydrocarbons whose natures are independent of the reaction medium used. These hydrocarbons, cyclic and polycyclic, for the most part have a very marked ethylenic character. (tr-auth)

27410 1-DEUTERIOPENTABORANE REARRANGEMENT. Thomas P. Onak, F. James Gerhart, and Robert E. Williams (Los Angeles State Coll. and Space General Corp., El Monte, Calif.). J. Am. Chem. Soc., 85: 1754-6(June 20, 1963).

Intramolecular deuterium–protium exchange takes place in 1-deuteriopentaborane when catalyzed by 2,6-dimethylpyridine at room temperature. In contrast, an intermolecular exchange mechanism prevails when 1-deuteriopentaborane undergoes deuterium–protium exchange at 145°. (auth)

27411 DEUTERIUM ISOTOPE EFFECT IN INTRAMOLECULAR INSERTION. M. J. Goldstein and S. J. Baum (Cornell Univ., Ithaca, N. Y.). J. Am. Chem. Soc., 85: 1885-6(June 20, 1963).

An example of isotopic discrimination in liquid phase CH insertion is reported. The addition of precooled methylene chloride in tetrahydrofuran to 1,1-di(methyl-d_3)ethyl lithium in the same solvent, at −65°C, produced deuterated 1,1-dimethylcyclopropane, separated from other products by distillation and gas chromatography. Nuclear magnetic resonance excluded the presence of >3% 1,1-dimethylethyl-d_5 chloride in the alkylithium precursor; excluded the presence of >0.8% isomeric alkenes in the purified product; and established the magnitude of the isotope effect. The area ratio, $(CH_2 + CH)/CH_3 = 1.47 \pm 0.04$, unchanged by resubmission of isolated products to reaction conditions, requires that $k_H/k_D = 1.71 \pm 0.06$. (P.C.H.)

27412 THE FORMATION OF 1,5,7,11-TETRATHIASPIRO[5.5]-UNDECANE IN THE REACTION OF CYCLIC TRIMETHYLENE TRITHIOCARBONATE WITH 2,2′-IMINODIETHANOL. Thomas P. Johnston, Carl R. Stringfellow, Jr., and Anne Gallagher (Southern Research Inst., Birmingham, Ala.). J. Org. Chem., 27: 4068-70(1962).

Reactions of ethylene trithiocarbonate with dimethylamine and morpholine did not give the high yields (about 95%) reported elsewhere. An attempt to prepare 3-mercaptopropyl bis(2-hydroxyethyl) dithiocarbamate from trimethylene trithiocarbonate and 2,2′-iminodiethanol gave a notable yield of a crystalline compound that was identified by elemental analysis, molecular weight, and the nuclear magnetic resonance spectrum as 1,5,7,11-tetrathiaspiro[5.5] undecane. The experiments are described, and the results of analyses of the products are given. (D.C.W.)

27413 SYNTHESIS AND EXCHANGE PROPERTIES OF ^{3}H-POLYVINYLACETATE. H. Heusinger (Technische Hochschule, Munich) and K. Reinhartz. Kerntechnik, 5: 213-17(May 1963). (In German)

A procedure was worked out for the synthesis of H^3-vinylacetate, starting from H^3-acetic acid (CH_3COOH^3) and H^3-acetylene ($H^3C \equiv CH^3$). It could be shown that the activity is built in almost quantitatively using H^3-acetylene, while acetic acid, labeled at the proton, attributes very little to the H^3-activity of the vinylacetate originating in the isotope effect. To investigate the delivery of activity from polyvinylacetate either by exchange or by volatile compounds, block and suspension polymerizates were prepared. The block polymerizates contain, in contrast to the suspension polymerizate, a considerable amount of H^3-labeled compounds, predominately monomers. It could be shown that in the polymer during storage a small amount of volatile H^3-compounds are produced. (auth)

Radiation Chemistry and Radiochemistry

Refer also to abstracts 27634, 27896, and 28441.

27414 (ASD-TR-7-840A(IX)) HYDRAZINE PROCESS DEVELOPMENT. Interim Technical Engineering Report, February through April 1963. H. J. Snyder, H. T. Watanabe, L. G. Carpenter, R. I. Miller, R. L. Pearson, and F. R. Standerfer (Aerojet-General Nucleonics, San Ramon, Calif.). Contract AF33(600)-42996. 126p. (AD-405712)

Work is being carried out to develop, design, construct, and operate a continuous, in-reactor, hydrazine production loop based on the fissiochemical process approach. Product decontamination, pure hydrazine irradiation, loop component testing, UO_2 crystal growth, fabrication and testing of AGN-302 experiment modules, catalytic hydrogen removal, hydrazine equilibrium concentration under radiolysis, additive effects, and a natural circulation reactor system are discussed. (auth)

27415 (BNL-6354) PHASE DEPENDENCE OF CARBON-11 RECOIL PRODUCTS IN PROPANE; EVIDENCE FOR METHYLENE INSERTION. Gerhard Stoecklin and Alfred P. Wolf (Brookhaven National Lab., Upton, N. Y.). [1962]. Contract [AT(30-2)-Gen-16]. 5p.

Results are included of a study of the formation of methylene-C^{11} complexes in neutron-irradiated propane in the gas, liquid, and solid phases. It is considered that

the results support the view that discrete species, such as carbon atoms, methyne, and methylene, react at thermal or near thermal energies in the gas phase accounting for a major fraction of the products. Products which contain C^{11} produced in the neutron reactions with propane are tabulated. (B.O.G.)

27416 (HW-73394) FISSION GAS YIELD IN URANIUM. J. W. Weber (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Apr. 13, 1962. Contract AT(45-1)-1350. 10p.

The yield of xenon and krypton in irradiated uranium was found to vary with neutron flux from 4.8 cm^3(STP)/cm^3 uranium-atom percent burnup at 10^{12} neut/cm^2-sec to 5.9 cm^3(STP)/cm^3 uranium-atom percent burnup at 10^{15} neut/cm^2-sec as a result of neutron capture by the unstable isotopes Xe^{133} and Xe^{135}. These results are applicable only to uranium irradiated in a thermal flux. The fission gas yields of uranium and plutonium are shown to be approximately equal. As a result, the total fission gas yield for uranium of natural and higher enrichments decreases less than 2% up to a total atom percent burnup of 0.6. The available data show a small difference in the isotope yield between fast and thermal fissioning. Inasmuch as fast fissioning is only a small percentage of the total fissioning in a thermal reactor, ignoring the difference in fast fission yield will not introduce a major error in the calculations. (auth)

27417 (HW-77126) RADIOIODINE SAMPLING WITH ACTIVATED CHARCOAL CARTRIDGES. D. McConnon (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Apr. 19, 1963. Contract AT(45-1)-1350. 15p.

The radioiodine collection efficiency of small activated charcoal cartridges was investigated under field conditions at a chemical processing plant stack. An average collection efficiency of 95% was obtained when the gas sample flow was limited to 0.1 cfm. A gamma spectrometer was calibrated for measurement of the I^{131} collected by the cartridges. Counting efficiencies of 1 and 10% were obtained for the two counting geometries used. Comparisons with results obtained with conventional caustic scrubber samplers indicate the need for further development of the charcoal cartridges. Recommendations are made to limit the use of the cartridges to situations where high I^{131} concentrations are expected, since a higher analytical precision is possible with increased I^{121} content in the cartridges. (auth)

27418 (IDO-16876) THE ELECTRON RADIOLYSIS OF BENZENE–M–TERPHENYL AND PERDEUTEROBENZENE–M–TERPHENYL MIXTURES. A. J. Moffat (Phillips Petroleum Co. Research and Development Dept., Bartlesville, Okla.). May 1, 1963. Contract AT(10-1)-1080. 14p.

Mixtures of benzene (also perdeuterobenzene) and m-terphenyl were irradiated with 6-Mev electrons. The primary polyphenyls products were biphenyl; o,m-, m,m-, and m,p-quaterphenyls; 1,2,3-, 1,2,4-, and 1,3,5-triphenylbenzenes; and approximately 21 of the possible hexaphenyls. The partial reactivities of the six distinguishable m-terphenyl positions were estimated from product distributions. Initial hexaphenyl product distributions were estimated for the radiolysis of m-terphenyl at 80°C. (auth)

27419 (JAERI-4024) IRRADIATION EFFECTS ON SOLID CATALYSTS. Shinichi Ohno (Japan Atomic Energy Research Inst., Tokyo). Feb. 1963. 16p. (In Japanese)

Studies of the radiation effects on catalysts and the influences of solids on the radiolytic reactions are discussed. Results obtained in this field and the experimental techniques used are described. Depending on the nature of the solid and its preparational method, as well as on the reaction examined and probably the experimental conditions, the radiation can accelerate the catalytic reaction, diminish it, or in some cases cause no change. Industrial irradiation of catalysts, however, may not be practical in many cases because the irradiation effects will anneal at usual reaction temperatures. (auth)

27420 (KR-40) PREPARATION OF CHROMIUM-51 BY SZILARD-CHALMERS REACTION AND SEPARATION BY ION EXCHANGE TECHNIQUES. O. R. Birkelund, N. Kaltenborn, and A. Rassoul (Norway. Institutt for Atomenergi, Kjeller). Feb. 1963. 21p.

A method for preparation of the radioisotope Cr^{51} in a form suitable for medical applications was worked out. Hexavalent chromium in the form of potassium chromate is used as target material. The trivalent Cr^{51} atoms produced by a Szilard-Chalmers reaction in the chromate crystals are separated from the hexavalent target compound by means of anion exchange. Investigations were made to determine the most favorable irradiation conditions in the Kjeller reactor JEEP. The established method represents a convenient method for routine preparation of Cr^{51} of high specific activity. (auth)

27421 (NP-12894) CHEMICAL EFFECTS OF NUCLEAR TRANSFORMATIONS. Bibliography. Review Report No. 6. A. Siuda (Polish Academy of Science. Inst. of Nuclear Research, Warsaw). 1963. 82p.

A bibliography containing 1013 references on the chemical effects of the nuclear transformations and chemical processes involving ions accelerated to high energy is presented. The references are arranged chronologically after years (1914 to 1963), and within a year the papers are ordered alphabetically according to the name of the author. An author index is included. (N.W.R.)

27422 (TID-17105) RADIATION CHEMISTRY OF IONIC SOLIDS. III. CHEMICAL STUDIES ON THE FORMATION AND ANNEALING OF RADICALS IN IRRADIATED NITRATES. Joseph Cunningham (Argonne National Lab., Ill. and Illinois Inst. of Tech., Chicago. Armour Research Foundation). Aug. 1962. Contract W-31-109-eng-38. 62p. (UAC-6769)

From a detailed analysis of the possible reactions occurring during dissolution of irradiated KNO_3 and $NaNO_3$ it was possible to interpret the results of studies of two distinct chemical solution-analyses. The growth of NO radicals to a saturation concentration was indicated by this interpretation and additional support was derived from comparison with EPR-signal growth studies. The first implication of the appearance of NO radicals as primary products was that an additional radiolytic path for decomposition exists. The expression $2NO_3^- \rightarrow 2NO + O_2 + 2O^-$ is used to denote this additional path. The consequences of growth of O^- radicals for both solution analyses were considered and it is shown that the mole ratio of solution-evolved oxygen to equivalent nitrite observed after dissolution can remain 1 : 2 as previously reported. Calculated G values for NO, NO_2^-, O_2, and O^- in the solid differed strikingly for 77 and 300°K. With reasonable assumptions it is possible to explain the wide variation in G_{NO} and $G_{NO_2^-}^{\bullet}$ values as arising solely from annealing secondary reactions occurring during irradiation at the higher temperature. For KNO_3 these annealing reactions are tentatively identified as: $NO + O_2 \rightleftharpoons NO_3$, $NO_3 + NO \rightarrow N_2O_4$.

$NO_3 + O^- \rightarrow NO_3 + O$, and $O + O \rightarrow O_2$. For $NaNO_3$ competition between the last reaction and $O + NO_2^- \rightarrow NO_3^-$, suffices to explain the otherwise anomalous decrease in $G_{NO_3^-}$ value from 77 to 300°K. (auth)

27423 (TID-18195) RADIOLYSIS OF ORGANIC FLUIDS. California Research–AEC Report No. 19. Annual Progress Report, October 1, 1961–September 30, 1962. R. O. Bolt, M. L. Burrous, J. G. Carroll, K. L. Hall, M. A. Sweeney, and M. W. Tobriner (California Research Corp., San Francisco). Jan. 15, 1963. Contract AT(04-3)-248. 72p.

Susie reactor work confirmed that fast neutrons are relatively more damaging than gamma rays to polyphenyl coolants. Tentatively, the damage ratio for equal energy input at 600°F varies from 1.9 to 3.6, depending on the compound studied. In the neutron-rich facility used, extensive radiation measurements show that about 95% of the energy absorbed in the coolant came from the slowing down of fast neutrons. Analyses of samples irradiated in the Susie program and the treatment of coolant burnup and radiation monitoring data are continuing on schedule. (auth)

27424 THE ACTION OF IONIZING RADIATION ON DRUGS, WITH SPECIAL CONSIDERATION TO STERILIZATION. I. GENERAL ASPECTS OF RADIATION STERILIZATION AND STUDIES ON THE READILY VOLATILE RADIOLYSIS PRODUCTS OF 1,2-PROPANDIOL, IRRADIATED WITH 1-Mev ELECTRONS IN AIR OR NITROGEN. G. Schwenker (Technische Hochschule, Karlsruhe, Ger.). Arch. Pharm. 294: 661-79(Oct. 1961).

Problems encountered in the radiosterilization of pharmaceutical preparations are discussed. After a consideration of the major disadvantages of this type of sterilization, namely, formation of radiolysis products by free radical mechanisms and thermal effects, and development of induced radioactivity in the irradiated material, it was concluded that high-speed electrons may offer the best radiation source for this purpose. The technique, using 1-Mev electrons generated by a van de Graaff accelerator and an irradiation chamber are described. The method was carried out on a series of 1,2-dihydroxy compounds, as model substances for carbohydrates. In addition to conventional dosimetry, a method was employed that involved the reduction of Ce(IV) ion to Ce(III), in the presence of $\underline{N}$ H_2SO_4, by ionizing radiation. Infrared spectra of the irradiated glycols ved no changes and gas chromatography showed only small new peaks in addition to the original compound. Radiolysis products formed from 1,2-propanediol after 100-Mrad doses in air (as mole%) were: acetaldehyde 0.04, propylene acetal 1.45, propionaldehyde + propylene propional 0.10, acetone 1.02, propylene ketal 0.66, methanol 0.33, ethanol 0.37, isopropanol 0.20, propylene formal 0.76, and water 10.00 (85 out of the original 100 mole% propanediol remained). The same products, with the exception of propylene formal, were formed when irradiation was conducted under N_2, but concentrations were much lower. Reaction mechanisms involved in the formation of the products are discussed. (TCO)

27425 ISOLATION OF CARRIER-FREE TELLURIUM FROM ANTIMONY TARGET. Yuji Yokoyama, Hisao Mabuchi, Hitoshi Shoji, and Nobufusa Saito (Tokyo Univ.). Bull. Chem. Soc. Japan, 36: 352-3(Mar. 1963). (In English)

A procedure was developed for separating Te from proton-irradiated Sb targets. The procedure involves the dissolution of the target in aqua regia and the extraction of Te by a solution of dithizone in $CHCl_3$ or CCl_4. (D.L.C.)

27426 EFFECT OF GAMMA IRRADIATION UPON CELLULOSE. Masao Horio, Rikizo Imamura, and Hideya Mizukami (Kyoto Univ.). Bull. Inst. Chem. Res., Kyoto Univ., 41: 17-38(Mar. 1963). (In English)

The purified cotton linter and purified wood pulp were irradiated by gamma radiation at various doses, and the number-average degree of polymerization (DP) of each sample was determined according to the method worked out by Immergut et al. by the measurements of intrinsic viscosity. The log-log plots of the difference between the reciprocal of DP of the irradiated cellulose and that of the original cellulose against the radiation dose ranging from 5.2×10^5 to 1.1×10^8 roentgens gave a straight line, which indicated that the chain cleavage took place in proportion to $R^{0.85}$, R being the radiation dose. The rapid decrease in the leveling off DP with increasing dose suggested that the cleavage took place equally likely both in amorphous domains and in crystalline domains. The reduction in size of crystallites was shown by electron microscopic observation. The analysis by a mass-spectrometer of the gas evolved from deuterated cellulose during the irradiation revealed that it was composed mostly of H_2 and HD, being accompanied by only a small amount of CO, CO_2, and CH_4. The primary reactions induced by gamma radiation were discussed. The carbonyl group and the carboxyl group were identified in the irradiated samples, which, however, showed enormously large copper numbers in comparison with the carbonyl content. Therefore, the measurements of copper number results in greatly overestimated values of carbonyl content. The high ratio of oxidant to carbonyl content would be due to the formation of various alkali-sensitive groups by irradiation. The formation of carbonyl group and carboxyl group were estimated to be proportional to $R^{0.85}$ similar to the case of chain rapture. A considerable amount of formic acid ester was found in the irradiated samples, which also would be an origin of producing very high copper numbers. The paper chromatographic analysis showed the hydrolyzate of strongly irradiated cellulose to contain an appreciable amount of xylose, arabinose and glucuronic acid besides glucose, which suggested the transformation of carbohydrate components by irradiation. Hypothetic formulas are given. (auth)

27427 THERMOLUMINESCENCE FROM GAMMA IRRADIATED AMINO ACIDS. Sadamu Tahira, Naoko Shiomi, and Takenobu Higashimura (Kyoto Univ.). Bull. Inst. Chem. Res., Kyoto Univ., 41: 48-54(Mar. 1963). (In English)

Radiation-induced thermoluminescence was studied for five amino acids. The crystalline samples which are pressed thin disks were irradiated at liquid nitrogen temperature and subsequently warmed to room temperature. Irradiation was carried out by Co^{60} γ rays and electron beams from a Van de Graaff accelerator. From the glow curves, three conclusions are drawn: (1) Glow curves for phenylalanine, tryptophan, which contain ring structures, have predominant peaks in temperature range 110 to 120°K with maximum intensity 12 μA. (2) Cystine has such a characteristic but it shows little dose dependency from 10^3 up to 10^7 r. (3) For amino acids except cystine, saturation occurs at about $10^5 \sim 10^6$ r. (auth)

27428 RADIOTHERMOLUMINESCENCE OF POLYETHYLENE AND DISAPPEARANCE OF FREE RADICALS. Naoko Shiomi, Sadamu Tahira, Hiroshi Yoshida, and Takenobu Higashimura (Kyoto Univ.). Bull. Inst. Chem. Res., Kyoto Univ., 41: 55-60(Mar. 1963). (In English)

Polyethylene sheet was cooled down to 77°K and irradiated by 1.5 Mev electron beam. After receiving a dose of

5×10^7 r, the temperature was raised saw-toothwise and the intensity of thermoluminescence glow and the concentration of surviving free radicals were measured at respective stages. The correlation of the intensity of thermoluminescence glow with the disappearance of free radicals at the respective temperatures was examined. The α and β peaks of thermoluminescence glow curve showed no correlation with the disappearance of free radicals but the γ peak showed remarkable dependence upon the disappearance. Dose dependences of the thermoluminescence glow and that of the free radical concentration were studied from 10^6 r to 10^7 r and the former showed saturation at 10^6 r while the latter does not saturate over this dose range. It was found that thermoluminescence has no direct correlation with the radical disappearance. It is concluded that thermoluminescence is ascribed to the release of energy stored which is resulted from a intra- or intermolecular motion. (auth)

27429 RADIATION SENSITIVITY OF AMINO ACIDS IN SOLUTION AND IN PROTEIN TO GAMMA RAYS. Hiroyuki Hatano (Kyoto Univ.), Shigetake Ganno, and Akira Ohara. Bull. Inst. Chem. Res., Kyoto Univ., 41: 61-70(Mar. 1963). (In English)

Radiation sensitivity of amino acids in solution and in protein to gamma rays was investigated by determining the rate of destruction of the amino acids in aqueous solutions and in proteinase proteins in solution after exposure to various doses of γ radiation. In aqueous solution, methionine, arginine, and histidine were proved to be radiosensitive but tyrosine, proline, and alanine were relatively radioresistant. In protein in solution, the constituent tyrosine of the proteinase was found to be most destructive contrary to free tyrosine in solution. The constituent phenylalanine and arginine of the protein were relatively more radiosensitive whereas the constituent proline, histidine, and threonine were less destroyed in the protein. Reaction yields and relative doses of 37 per cent destruction of amino acids were presented. It was remarkable that even after exposure to about 100 kiloroentgen dose of γ rays, which cause destruction of almost the constituent tyrosine of the proteinase, about 50 per cent remaining activity of the enzyme could be detected on the damaged enzyme protein. (auth)

27430 ELECTRON SPIN RESONANCE STUDIES ON THE MECHANISM OF ENZYME INACTIVATION BY DIRECT ACTION OF GAMMA RADIATION. Hiroyuki Hatano, Shigetake Ganno, and Souji Rokushika (Kyoto Univ.). Bull. Inst. Chem. Res., Kyoto Univ., 41: 71-5(Mar. 1963). (In English)

Electron spin resonance spectra of a sulfhydryl enzyme, urease, and a non-sulfhydryl enzyme, bacterial proteinase, were observed after exposure to irradiation of γ rays. Urease showed a characteristic pattern to a sulfhydryl protein and bacterial proteinase to a non-sulfhydryl protein. A quantitative relationship among inactivation of the proteinase, intensity of ESR signal of the enzyme, and irradiation dose of γ rays, was measured. Whereas in an early process of the inactivation any significant increase of the intensity of ESR pattern was not observed, a parallel relationship between the inactivation of the enzyme and the increase of free radicals was found in a range from 100 kiloroentgen dose to 10 megaroentgen dose of γ rays and no significant increase of the free radicals was found contrary to further progress of the inactivation of the enzyme in the course of the irradiation of larger doses than 10 megaroentgens. Possibility of conduction of electron vacancy from a damaged area of the enzyme molecule to an active center on the enzyme, and an inactivating mechanism by direct action of gamma radiation, were proposed and discussed. (auth)

27431 OXIDATIVE DEAMINATION OF SEVERAL AMINO ACIDS IN AQUEOUS SOLUTION BY GAMMA IRRADIATION. Hiroyuki Hatano and Souji Rokushika (Kyoto Univ.). Bull. Inst. Chem. Res., Kyoto Univ., 41: 76-82 (Mar. 1963). (In English)

A general overall reaction of oxidative deamination of amino acid in aqueous solution, $H_2NRCHCOOH \rightarrow NH_3 + RCOCOOH$, was characterized on leucine, α-aminobutyric acid, and aspartic acid after exposure to γ irradiation. Keto acids corresponding to the parent amino acids were produced by γ irradiation and determined quantitatively by chromatography and spectroscopic measurements after being derived to 2,4-dinitrophenylhydrazones. Some spectroscopic and chromatographic properties of the keto acid hydrazones are reported. (auth)

27432 RADIATION EFFECT ON THE NUCLEIC ACID. Yasuo Imai (Kyoto Univ.). Bull. Inst. Chem. Res., Kyoto Univ., 41: 97-102(Mar. 1963). (In English)

Changes of magnetic properties of nucleic acid by γ ray or neutron irradiation are chiefly described. Diminution of the ferromagnetic property of native nucleic acid samples by irradiation in water media was observed by the ESR and static magnetic susceptibility measurements at the room temperature. (auth)

27433 THE POLYMERIZATION OF FLUORO-OLEFINES INITIATED BY RADIATION. V. A. Khramchenkov. Dokl. Akad. Nauk SSSR, 149: 338-40(Mar. 11, 1963). (In Russian)

The polymerization of a number of fluoro-olefines was studied by irradiating with Co^{60} γ rays in "bulk" at 20 to 25°C. The polymerization of 2,3,3,3-tetrafluoropropene-1 went most readily with a radiation yield of 350 molecules/100 ev (based on the consumption of monomer). The absence of double-bond conjugation with a C – F bond in position 1 in this case accounted for the ready polymerization of this compound. The radiation yield dropped to 88 molecules/100 ev for a compound with a C – F bond in position 1 such as 1,2,3,3,3,-pentafluoropropene-1. The C – F bond in position 2 did not have much of an effect on the polymerization of perfluoropropylene ($CF_2 = CH - CF_3$), because the radiation yields of oligomeres formed during the irradiation of perfluoropropylene and 1,1,3,3,3,-pentafluoropropene-1 were approximately the same (13 and 9 molecules/100 ev respectively). Double-bond conjugation with a CF_3 substituent group had a much greater effect than a C – F bond in position 2 in inhibiting the reaction. With prolonged irradiation, the rate of polymerization decreased in every case. (TTT)

27434 THE EFFECT OF IODINE ON THE ELECTRICAL PROPERTIES OF POLYETHYLENE MODIFIED BY IRRADIATION AND BY THERMAL TREATMENT. A. V. Vannikov and N. A. Bakh (Inst. of Electrochemistry, Academy of Sciences, USSR). Dokl. Akad. Nauk SSR, 149: 357-9(Mar. 11, 1963). (In Russian)

High-pressure polyethylene samples were given a dose of 1.5×10^{24} ev/g in a reactor, and were given a thermal treatment at temperatures of 295, 350, 445, 520, 620, and 785°C. The electrical conductivity σ, the thermal emf α (μV/deg) and activation energy ΔE(ev) were determined. Samples iodinated at 20°C showed an increase in conductivity from 3×10^{-10} to 0.8×10^{-2} ohm^{-1}-cm^{-1} as compared to uniodinated samples after thermal treatment at 445°C. The thermal emf was also higher, and varied only slightly with temperature. From –80 to +20°C, lg σ (conductivity)

varied linearly as 1/T. On iodinating the polyethylene at 240°C, the conductivity increased substantially, but the thermal emf varied considerably with temperature, and changed sign from positive conductivity (p-conductivity) to negative conductivity (n-conductivity). The results showed that it is possible to prepare organic materials with a given type of conductivity. (TTT)

27435 THE ELECTRON PARAMAGNETIC RESONANCE SPECTRUM OF A HYDRATED ELECTRON IN THE IRRADIATION OF FROZEN ALKALINE SOLUTIONS. B. G. Ershov, A. K. Pikaev, P. Ya. Glazunov, and Vikt. I. Spitsyn (Inst. of Physical Chemistry, Academy of Sciences, USSR). Dokl. Akad. Nauk SSSR, 149: 363-6(Mar. 11, 1963). (In Russian)

The hydrated electron was predicted theoretically, but since it reacts readily with hydrogen ion to give atomic hydrogen ($e^-_{aq} + H_3O^+ \rightarrow H + H_2O$), it does not appear on an EPR (electron paramagnetic resonance) spectrum. The e^-_{aq} should stabilize and show an EPR spectrum in alkaline solution. Solutions 1.0M, 5.0M, and 10M in KOH were irradiated with 0.9-Mev electrons at −150 and −196°C with a total dose of 3×10^{20} ev/ml. A wide line with a g-factor of 2.04 was detected in 1.0M frozen KOH with the intensity of the line rising with increasing concentration of KOH. This wide line was assigned to the hydrated ion-radical $O^- \cdot nH_2O$, occurring as a result of the following reaction: $OH + OH^- + (n-1)H_2O \rightarrow O^- \cdot nH_2O$. A decrease in the intensity of the lines belonging to the OH radical was observed simultaneously with the appearance of a narrow line having a g-factor corresponding to the g-factor of the free electron (g-factor of 2.002, and ΔH = 13 oerst.). With increasing concentration of KOH, the color of the irradiated ice changes from azure to dark blue. The narrow line due to the hydrated electron was also observed in a 10M KOH solution of heavy water, but with a compressed width (ΔH = 7 oerst.). The yield of radicals in the ice irradiated at −196°C increases with increasing concentration of KOH due to stabilization of the hydrated electron e^-_{aq} and the conversion of OH to $O^- \cdot nH_2O$. (TTT)

27436 HYDRAZINE FORMATION IN THE GAS-PHASE RADIOLYSIS OF AMMONIA. F. W. Lampe (William H. Johnston Labs., Inc., Baltimore), E. R. Weiner, W. H. Johnston, and W. S. Koski. Intern. J. Appl. Radiation Isotopes, 14: 231-5(June 1963). (In English)

Sensitization of the deuteron radiolysis of gaseous ammonia by rare gases has a striking effect on the hydrazine yield which is a reflection of the course of the reaction. The hydrazine yield is increased four-fold with sensitization by krypton and decreased three-fold with sensitization by neon. These results are in accord with the proposed ionic mechanism of initiation by charge transfer from the rare gas to the ammonia, with subsequent ammonia ion decomposition being dependent upon the recombination energy of the rare gas ion. The results are also in agreement with the proposal that hydrazine yields are limited by the stationary hydrogen atom concentration characteristic of the radiolysis conditions. (auth)

27437 RADIATION-INDUCED CYANOGENATION OF ORGANIC LIQUIDS. J. A. Knight, C. J. Bryan, and R. A. Stokes (Georgia Inst. of Tech., Atlanta). Intern. J. Appl. Radiation Isotopes, 14: 239-40(June 1963). (In English)

Several hydrocarbons were irradiated in admixture with cyanogen and the infrared spectra studied for evidence of gross cyano products. No absorption was found in either the irradiated hydrocarbons or the distillate of irradiated hydrocarbon−cyanogen mixtures, but the higher boiling fraction from each mixture showed a very strong absorption band at ~4.4 μ. The irradiated cyclohexane−cyanogen mixtures were analyzed by gas chromatography, and cyclohexyl cyanide was found. The G-value for cyclohexyl cyanide was ~7 for doses below 5×10^{20} ev/g but decreased to ~5 for a dose of 1.5×10^{21} ev/g. (D.L.C.)

27438 RADIATION PROTECTION BY SULPHUR IN A MODEL SYSTEM. P. G. Garratt and M. G. Ormerod (Royal Military Coll. of Science, Shrivenham, Wiltshire, Eng.). Intern. J. Radiation Biol., 6: 281-7(Mar. 1963). (In English)

Room temperature irradiation of the liquid polymer, polymethylvinylsiloxane, produces stable free radicals which can be observed using electron spin resonance (ESR). The radiation protection of this polymer with sulfur was studied by measuring the increase in the gelation dose. At the same time ESR was used to observe the free radical concentration. It was confirmed that colloidal sulfur is a good radiation protector and it was shown that this can be attributed, at least in part, to its efficiency as a radical scavenger. (auth)

27439 EFFECTS OF GAMMA RADIATION ON ELECTRON PARAMAGNETIC RESONANCE IN $CuSO_4 \cdot 5H_2O$. E. A. Zamotrinskaya (Tomsk State Univ., Siberian SSR). Izv. Vysshikh Uchebn. Zavedenii, Fiz., No. 2, 178-9(1963). (In Russian)

Measurements of γ-radiation effects on paramagnetic resonance in $CuSO_4 \cdot 5H_2O$ monocrystals indicated a reduction in resonance intensity and an increase in the half-width of the resonance curve. Radioinduced variations persisted following radiation cut-off. Irradiation with 5×10^5 r produced approximately two-fold reduction in resonance intensity and a half-width increase of 159 to 238 gf. (R.V.J.)

27440 EFFECT OF γ RAYS ON AQUEOUS SOLUTIONS OF IRON THIOCYANATES. Ignazio Renato Bellobono and Marcelle Duflo (Faculte des Sciences, Paris). J. Chim. Phys., 60: 387-96(Mar. 1963). (In French)

Acid solutions of ferrous thiocyanate were exposed to γ radiation in the presence or absence of oxygen. The variation in the yields of cyanide, sulfate, and ferric ions was studied as a function of the thiocyanate ion and sulfuric acid concentrations. From these yields, a simplified scheme for the radiolysis mechanism of ferrous thiocyanate could be established. (tr-auth)

27441 RADIOLYSIS OF POTASSIUM FERROCYANIDE AND FERRICYANIDE SOLUTIONS. E. Masri and M. Haissinsky (Faculté des Sciences, Paris). J. Chim. Phys., 60: 397-401(Mar. 1963). (In French)

The radiolytic transformations of potassium ferricyanide and ferrocyanide irradiated by Co^{60} γ rays were studied. In acid solution (pH 0.5) the ferricyanide disappears and ferropentacyanide is formed with a yield that varies between 0.1 and 0.7, when the concentration of the solution increases from 5×10^{-4} to 2×10^{-2}M. The disappearance yields of the ferricyanide are 2 to 2.5 times higher than the formation of the ferropentacyanide. These yields increase slightly with the pH (up to pH 6). A prolonged irradiation leads to progressive degradation of the solution. Irradiated ferrocyanide is oxidized into ferricyanide that, in its turn, if the irradiation is sufficiently prolonged, undergoes the transformation described above. The oxidation continues for several hours after irradiation. The oxidation yield in concentrated solution (10^{-2}M) reaches 7 immediately after the irradiation ceases and about 10.5 after the prolonged effect. A qualitative interpretation of the observations described is attempted. (tr-auth)

27442 RADIOLYSIS OF NOBLE METAL COMPOUNDS IN AQUEOUS SOLUTION. II. EFFECT OF γ RAYS ON ALKALINE SOLUTIONS OF Pt^{2+} AND Pt^{4+}. M. Haissinsky (Faculte des Sciences, Paris). J. Chim. Phys., 60: 402-6 (Mar. 1963). (In French)

The oxidation of bivalent platinum in alkaline solution (pH 13.1) under the action of Co^{60} γ rays in the presence and absence of air and the reduction of tetravalent platinum in degassed and benzene-saturated alkaline solution were studied. The yields measured lead to the following values: $G_H = 2.72$, $G_{OH} = 3.20$, $G_{H_2} = 0.30$, $G_{H_2O_2} = 0.11$, and $G_{-H_2O} = 3.37$. These values are in very good agreement with those found previously in the study of the oxidation of Te^{4+} but differ partly in the radical and molecular yields deduced by other workers from measurements of ferricyanide reduction. (tr-auth)

27443 SELF-DECOMPOSITION OF TRITIATED THYMIDINE IN AQUEOUS SOLUTION. Sonia Apelgot and Bernard Ekert (Université, Paris). J. Chim. Phys., 60: 505-9 (Apr. 1963). (In French)

The decomposition products formed at 4°C in an aged solution of tritiated thymidine were studied by paper chromatography. There was a good correlation between the products formed during self-decomposition and the products of the x radiolysis of 0°C of "cold" thymidine in solution. (tr-auth)

27444 STUDIES OF THE SOLUTION POLYMERIZATION OF VINYL ACETATE IN THE AQUEOUS SOLUTION OF PARTIALLY ACETYLATED POLYVINYL ALCOHOL. V. THE RADIATION-INDUCED GRAFT COPOLYMERIZATION. Chen-chong Lin (Union Industrial Research Inst., Ministry of Economic Affairs, Taipei, Taiwan, China). J. Chinese Chem. Soc. (Taiwan), 8: 135-43(May 1961).

Graft copolymerization was induced to a considerable extent when vinyl acetate was polymerized in an aqueous solution of polyvinyl alcohol (PVA) or partially acetylated PVA under γ irradiation. The radioinduced graft copolymerization was affected by hydroquinone. The graft efficiency, f_{ac}, increased as PVA concentration increased. However, it reached a critical value at 4% and decreased again in more concentrated solutions. It was found that f_{ac} decreases with increasing field intensity of irradiation at a finite total exposure dose. A mechanism consistent with the observations is given. The higher rate of grafting in radiation polymerization is attributed to the high free radical concentration on PVA main chain. A larger value of graft efficiency in PVA acetate solution than that in PVA solution may be explained by the affinity of vinyl acetate for PVA or PVA acetate. It was concluded that the affinity of vinyl acetate for PVA greatly promotes the grafting reaction. However, chain cross-linking of PVA must also be taken into consideration in the case of the radiation-initiated polymerization. (TCO)

27445 SEPARATION OF RADIOELEMENTS BY PAPER ELECTROPHORESIS AT HIGH TENSION. J.-P. Adloff and R. Bertrand (Centre de Recherches Nucléaires, Strasbourg). J. Electroanal. Chem., 5: 461-6(June 1963). (In French)

Paper electrophoresis in a high electric field of 80 v/cm in the presence of complexing organic acids permits rapid separation of radioelements of short half-life. Francium was separated from actinium in equilibrium with its disintegration products. (auth)

27446 THE SEPARATION OF ^{239}Np. Yu. A. Zolotov and I. P. Alimarin (Vernadskii Inst. of Geochemistry and Analytical Chemistry, Moscow). J. Inorg. Nucl. Chem., 25: 719-20(June 1963).

A solvent extraction process for the separation of Np^{239} from uranium and its fission products is described. The process is based on the selective extraction of Np(VI) by diethyl ether from nitric acid solutions in the presence of a salting out agent and on the differences in the behavior of Np(VI) and Np(V). The recoil of the fission product nuclei is used to separate Np^{239}. The procedure is also applicable to Np^{237}, Pu, and U. (C.E.S.)

27447 SEPARATION OF PURE ^{90}Y FROM A ^{90}Sr–^{90}Y MIXTURE BY CO-PRECIPITATION WITH FERRIC HYDROXIDE. Yoshio Koda (Government Industrial Research Inst., Nagoya, Japan). J. Inorg. Nucl. Chem., 25: 733-4 (June 1963).

A process to obtain a high degree of separation of Y^{90} from a Sr^{90}–Y^{90} mixture was described. Pyridine was used to overcome the difficulties due to the strong adsorptive power of gelatinous hydrated ferric hydroxide in the standard method of separation by co-precipitation with ferric hydroxide. (C.E.S.)

27448 SOLID-STATE POLYMERIZATION OF METHACRYLAMIDE AND N-ARYLMETHACRYLAMIDES. P. Jaeger and E. S. Waight (Imperial Coll. of Science and Tech., London). J. Polymer Sci., Pt. A, 1: 1909-17(June 1963). (In English)

The γ-ray initiated solid state polymerization of methacrylamide at room temperature is described and discussed in terms of reaction mechanisms previously applied to the radiation-induced polymerization of acrylamide. Log (M_0/M) increased, after a short initiation period, linearly with $(time)^2$ up to conversions of about 20%. This was followed at higher conversions by a second linear region with a higher slope. The conversion rate (%/Mrad) increased for intensities between 0.3 and 0.075 Mrad/hr, but it dropped unexpectedly at the lowest dose rates. Irradiated methacrylamide showed a post-irradiation polymerization, the rate of which was influenced by the presence of air for reaction times longer than 200 hr. Among the solid N-arylmethacrylamides, which were all less reactive than methacrylamide, some ortho-substituted compounds (o-Cl, o-Br, o-ethoxy) showed a relatively high reactivity. These results are discussed in connection with differences in hydrogen bonding found in the infrared spectra. (auth)

27449 EXAMINATION OF KINETICS OF GRAFT COPOLYMERIZATION ON PREIRRADIATED POLYMETHYL METHACRYLATE. E. Turska and S. Połowiński (Politechnika Lodzka, Lodz, Poland). J. Polymer Sci., Pt. A, 1: 2085-92(June 1963). (In English)

The kinetics of graft copolymerization of vinyl acetate on polymethyl methacrylate was investigated. Polymethyl methacrylate was preirradiated in the presence of air by γ rays, the polymer being used as the initiator of the polymerization in the one-phase system. The rate of reaction for low conversion is proportional to the concentration of monomer raised to the power of $^3/_2$ and to the concentration of initiator to the $^1/_2$ power. The reaction satisfied the kinetic equation for ordinary addition polymerization if the decrease of the amount of the initiator during the process is taken into consideration. The activation energy of this process was found. The quantity of the homopolymers produced in this reaction is negligible and need not be taken into account in rough calculations as far as kinetics are concerned. (auth)

27450 ELECTRON SPIN RESONANCE STUDIES ON PEROXIDE RADICALS IN IRRADIATED POLYPROPYLENE. H. Fischer, K.-H. Hellwege, and P. Neudoerfl (Deutsche

Kunststoff-Institute, Darmstadt, Ger.). J. Polymer Sci., Pt. A, 1: 2109-17(June 1963). (In German)

Peroxide radicals are formed by oxidation of carbon radicals in irradiated isotactic polypropylene. An interpretation of their ESR spectra is given. The recombination of the peroxide radicals follows a chain reaction mechanism, which is derived from the reversibility of formation of peroxide radicals, the time dependence of their concentration, and from the oxygen consumption of samples containing peroxide radicals. The reactions are discussed in view of the radiation induced oxidative degradation of polypropylene. (auth)

27451 FLUORESCENCE OF SOLUTION SCINTILLATORS WITH NAPHTHALENE AS A SOLVENT. Shigeo Kobayashi and Sohachiro Hayakawa (Tokyo Inst. of Tech.). Japan. J. Appl. Phys., 2: 281-8(May 1963). (In English)

It is shown that solute concentration dependence of fluorescence intensity in solution scintillators with naphthalene as solvent follows the formula given by Kallmann and Furst et al. with respect of energy transfer in liquid scintillators. Measurements of fluorescence under excitation of different radiations can discriminate between solvent and solute quenching by addition of carbon tetrachloride. Pulse distribution curves are also investigated at an optimum concentration of each system. Some of them seem worthy of practical use. (auth)

27452 STUDIES ON X-AGENT. XVIII. EFFECT OF X-AGENT ON SOLUTIONS OF METHYL RED AND OTHER SUBSTANCES. Hideo Moriyama (Shonan Hygiene Inst., Kamakura, Japan). Japan. J. Microbiol., 5: 395-416(Oct. 1961).

Solutions of various dyes, such as methyl red and phenolphthalein, were altered by an unidentified physical factor, X-agent, possibly of cosmic origin. The color intensities of dilute solutions of the dyes were weakened by the agent, in analogy to changes in the turbidities of protein solutions and kaolin suspensions previously noted after exposure to the agent. The penetrating power of the X-agent involved in the color changes was great. A 10-cm lead shield failed to block the color change. The component of X-agent that affects the color intensity appears to be emitted by various substances, such as water and lead. The emission is frequently greater on the north side of the substance. X-agent fluctuates markedly in intensity with time. The fluctuation tends to occur over periods of a few days not only in quantity but in quality. The agent also seems to undergo seasonal variations, exhibiting the highest intensity in the late spring or the early summer. X-agent is postulated to be a photon that has been temporarily changed in character by the substance through which it has passed. The scattering of the altered photon, or X-agent, is considered in terms of a Compton effect when the X-agent is an altered γ ray, or of a Tyndall effect when it is a changed visible photon. The directional patterns or the peculiar curves observed are regarded as Compton-scattering patterns or Tyndall-light patterns of X-agent scattered in a water vessel or a lead pile. (H.H.D.)

27453 EVALUATION METHOD FOR ABSOLUTE MEASURING OF COMPOUNDS LABELLED WITH C^{14} WITHIN SCINTILLATING LIQUIDS. L. Zollfrank and R. Reichel (Zentralinstitut fllr Kernphysik, Rossendorf, Ger.). Kernenergie, 6: 163-8(Apr. 1963). (In German)

It is possible, using a scintillation counter, to determine the absolute decay rate of C^{14}-labeled compounds in liquid scintillators, even for strongly quenched materials, with a maximum error of about ±3%. The length of time for a test amounted to about 30 min. The process can be extended to other β emitters (for example S^{35}). (tr-auth)

27454 ELECTRON SPIN RESONANCE INVESTIGATIONS OF IRRADIATED CARBOHYDRATES. S. Dilli and J. L. Garnett (Univ. of New South Wales, Kensington, Australia). Nature, 198: 984-5(June 8, 1963).

Electron spin resonance measurements were performed on a series of irradiated sugars. Irradiations were carried out in a Co^{60} source at dose rates of 1.25×10^6 rads/hr in both vacuum and air to total doses of 10^7 and 10^8 rads. The spectra of the irradiated monosaccharides, disaccharides, and polysaccharides were similar and showed little hyperfine structure. The significant feature was the doublet of 15-20 gauss separation exhibited by all compounds with the exception of lyxose and lactose, that produced four-line spectra. Amylose and amylopectin produced only very weak signals. (C.E.S.)

27455 SPUR REACTIONS IN THE RADIOLYSIS OF LIQUID ALIPHATIC HYDROCARBONS. John W. Falconer (Atomic Weapons Research Establishment, Aldermaston, Berks, Eng.). Nature, 198: 985-6(June 8, 1963).

Spur reactions occurring in the radiolysis of cyclohexane and neopentane are discussed but the arguments apply to liquid aliphatic hydrocarbons in general. Because the most probable spur reactions lead to intermediates and products similar to those formed by reactions occurring in the bulk of the liquid, no obvious indication of the occurrence of spur reactions is to be expected from an analysis of the main products of reaction. Evidence for spur reactions must be sought from an examination of minor products of reaction, effects of linear energy transfer, and effects of solutes. (C.E.S.)

27456 SZILARD-CHALMERS REACTION ON METHYL IODIDE WITH SIMULTANEOUS EXTRACTION DURING IRRADIATION. Kristian Svoboda (Inst. of Nuclear Research, Czechoslovak Academy of Sciences, Prague). Nature, 198: 986-7(June 8, 1963).

The distribution of iodine-128 between the organic and inorganic fraction when irradiating methyliodide with thermal neutrons accompanied by a high intensity of γ radiation is investigated. Fifty ml of methyliodide was subjected to a neutron flux in the range $10^5 - 10^6$ n $cm^{-2}sec^{-1}$ and a γ radiation of 5 – 10 r/hr. The results suggest that the organic yield of iodine-128 in irradiated methyliodide caused purely by hot atom processes is 50 per cent. (C.E.S.)

27457 AMPEROMETRIC STUDY ON THE REACTION BETWEEN THORIUM AND ALKALI MOLYBDATE. Ram Sahai Saxena and M. L. Mittal (Government Coll., Kota, India). Naturwissenschaften, 50: 373(1963). (In English)

The reaction between Th^{4+} and MoO_4^{2-} was investigated using amperometric titrations of thorium nitrate with sodium molybdate at a dropping mercury electrode at an applied potential of –1.6 v. The amperometric end point corresponds to the formation of normal thorium molybdate $ThO_2 \cdot 2MoO_3$ at pH range from 4.2 to 5.8. The precipitation of thorium molybdate was found to be quantitative, and the reaction offers a simple, rapid, and accurate method for the determination of thorium as molybdate at suitable concentrations of the reactants. (auth)

27458 RADIATION-INDUCED REACTION OF HEPTANE, NONANE, OR CUMENE WITH CO_2. E. P. Kalyazin and V. I. Makarov. Neftekhimiya, 3: 227-32(Mar.-Apr. 1963).

The reaction of n-heptane, n-nonane, or cumene with CO_2 was induced by x and γ radiation from a Co source in order to study the effect of radiation intensity, temperature, and

CO_2 concentration on the reaction. The reaction was carried out in sealed ampoules. The yield of acids, esters, and carbonyl compounds was found to be independent of γ intensity in the range from 3.8×10^{16} to 1.1×10^{14} ev/ml/sec. The reaction showed no temperature dependence from −77 to +145°C. The radiation yield varied as a function of CO_2 concentration. For CO_2 concentrations from 6×10^{-4} to 8.9 mol/l, the maximum acid yield, 0.9, was at 2 mole/l of CO_2, and the maximum carbonyl-compound yield, 0.29 molecule/100 ev, at 8.9 mole/l of CO_2. The carbonyl compounds are assumed to result from the direct effect of radiation on the dissolved CO_2, which is in good agreement with their linear yield increase with increasing CO_2 concentration. (OTS)

27459 SEPARATION OF RADIOACTIVE IRIDIUM FROM RHENIUM IRRADIATED WITH α-PARTICLES. Kazuo Saito, Yasushi Inoue, and Toshimitsu Yamazaki (Tokyo Univ.). Nippon Kagaku Zasshi, 84: 220-4(Mar. 1963). (In Japanese)

The separation of Ir from rhenium target was examined. Co-precipitation of iridium with $Fe(OH)_3$ is almost quantitative at pH 8.0 to 9.5 in the presence of more than 1 mg of Fe. The precipitate is free from Re on re-precipitation. The carrier Fe is removed by extraction with diethylether or methyl-isobutylketone from HCl solution. Fe is also removed by the use of cation exchange resin with 0.01 to 2M HCl as eluting agent for Ir; Fe remains on the resin column. Radioactive Ir is electrolytically deposited on a thin nickel foil from 1M $(NH_4)_2SO_4$ solution of pH about 4. Addition of a very small amount (less than 15μg) of Fe(III) facilitates the electrolysis, and does not vitiate the measurement of internal conversion electron spectrum of Ir^{186}, Ir^{187}, and Ir^{188}. By irradiation with α rays of 40 Mev (10 to 15μa, 24hr) 20mC each of Ir^{187} and Ir^{188} was obtained carrier free; the radiation dose on the procedure is less than 30mr for 10mC. (auth)

27460 SOLVENT EXTRACTION OF RADIO-RUTHENIUM AS THE THIOCYANATE COMPLEX. Yoshinaga Oka and Toyoaki Kato (Tohoku Univ., Sendai). Nippon Kagaku Zasshi, 84: 249-53(Mar. 1963). (In Japanese)

The solvent extraction behavior of radioruthenium, as the thiocyanate complex from hydrochloric, sulfuric, and perchloric acid solution was investigated. Ruthenium forms the violet-blue complex on moderate heating with excess thiocyanate as the reductant and the complexing agent. The complex is extractable by liquid amines or oxygenated solvents from acidic solutions. After heating radioruthenium in aqueous 1 mole/l HCl − 0.5 mole/l NH_4NCS solution for 15 min at 70°C, it was almost completely extracted by tri-n-octyl amine hydrothiocyanate in cyclohexane or by tri-n-butyl phosphate (TBP). Concentration dependences of aqueous acid, thiocyanate, and organic solvents on distribution ratios of radioruthenium were examined and the probable species to be extracted was shown to be $HRu(NCS)_4$. In TBP extraction systems involving thiocyanate, distribution ratios of radioruthenium were largely enhanced compared with those obtained in mineral acid-TBP systems containing no thiocyanate. (auth)

27461 KRYPTONATES: Kr^{85} BECOMES A UNIVERSAL TRACER. D. Chleck, R. Maehl, and O. Cucchiara (Parametrics, Inc., Waltham, Mass.). Nucleonics, 21: No. 7, 53-5(July 1963).

Techniques for introducing krypton into solids forming kryptonates, in which the Kr^{85} can be used as a tracer, were developed. Krypton was perfused into solids at high pressure and temperature and was ionized and impelled into solids under a potential drop. The kryptonates are stable and radioactively safe. Kr^{85} is therefore a universal tracer and some of its uses are described. (D.C.W.)

27462 TWO METHODS TO DETERMINE Co^{60} DISINTEGRATION RATE. Jerry R. Bell and Paul R. Cheever (General Dynamics, Fort Worth, Tex.). Nucleonics, 21: No. 7, 58; 60; 62-3(July 1963).

Two methods for determining the absolute activity of Co^{60} sources are described. An improved β-γ coincidence method gives disintegration rates accurate to ±2% with precision of ±1%. The other method, based on the coincidence analysis of single crystal gamma spectral data, gives disintegration rates about 2% less than the preceding method. Theory and procedures are discussed. (D.C.W.)

27463 SCINTILLATION PROCESS IN CsI(Tl). I. COMPARISON WITH ACTIVATOR SATURATION MODEL. R. Gwin and R. B. Murray (Oak Ridge National Lab., Tenn.). Phys. Rev., 131: 501-8(July 15, 1963).

The scintillation efficiency of CsI(Tl) crystals, containing varying amounts of Tl, was measured upon excitation by gamma rays, protons, and alpha particles in the kev and Mev region. A critical test of a previously proposed phenomenological model of the scintillation process in activated alkali halides was provided. In order to achieve this goal, special attention was paid to technical effects that might distort the data, viz., effects dependent on the emission spectrum and the pulse analysis time. It is concluded that the variation of the scintillation efficiency as a function of the stopping power of the incident particle is predicted by the scintillation model when the effect of secondary electrons is taken into account. It is found that the shape of the scintillation efficiency versus dE/dx curve is very nearly independent of Tl concentration. It is concluded from this fact that the decline in scintillation efficiency for highly ionizing particles is not due to saturation of activator centers. (auth)

27464 SCINTILLATION PROCESS IN CsI(Tl). II. EMISSION SPECTRA AND THE POSSIBLE ROLE OF SELF-TRAPPED HOLES. R. Gwin and R. B. Murray (Oak Ridge National Lab., Tenn.). Phys. Rev., 131: 508-12(July 15, 1963).

The luminescence emission spectra of CsI(Tl) crystals containing varying amounts of Tl were measured upon excitation by gamma rays, protons, and alphas. The principal features include a broad Tl emission band centered near 5500 Å and a narrower band centered near 3300 Å that is characteristic of the host crystal. This 3300-Å band is analogous to near-ultraviolet emission bands observed in NaI and KI. It is found for CsI(Tl) that the intensity of the 3300-Å band relative to the Tl band is greatest upon excitation by radiation of high dE/dx. It is suggested that the 3300-Å band arises from the recombination of free electrons with self-trapped holes. Evidence from other investigations supporting this hypothesis is summarized. (auth)

27465 RADIOLYSIS PRODUCTS FROM THE X-IRRADIATION OF 2,2,4,6,6-PENTAMETHYLHEPTANE. J. A. Knight and Fred Sicilio (Georgia Inst. of Tech., Atlanta). Radiation Res., 19: 359-67(June 1963).

In addition to hydrogen, there are at least seventy-three radiolysis products from the x irradiation of PMH. Thirty-four of these products are in the C_1 to C_{11} range with a total G ~ 4.9 and with individual G values ranging from 0.001 to 1.2. Thirty-nine are in the C_{12} to C_{24} range with a total G ~ 2.1 and with individual G values ranging from 0.003 to 0.23. Twenty-six of the products in the C_1 to C_{10} range were identified, of which the major ones are methane, isobutane, isobutylene, neopentane, 2,2,4-trimethylpentane,

and 2,4,4-trimethylpentene-1. Since authentic hydrocarbon samples of the types expected from radiolysis of PMH are not available, identification of products in the C_{11} to C_{24} range was not possible. In the C_1 to C_{11} range, the processes that lead to a product which can be related to some portion of the carbon skeleton of the parent hydrocarbon predominate. Also, the processes that lead to products of carbon content less than the parent hydrocarbon predominate over those that lead to products of carbon content equal to or greater than the parent hydrocarbon. Molecular-weight measurements and gas chromatographic evidence indicate very strongly that the highest-molecular-weight products, at least in the earlier stages of radiolysis, are those of C_{24} carbon content. In addition to the identification of unsaturated products in the C_1 to C_{11} range, evidence for unsaturation in the C_{12} to C_{24} range was obtained from H_2 uptake measurements and infrared spectra. (auth)

27466 ^{60}Co γ RADIOLYSIS OF POTASSIUM DICHROMATE IN ACID SOLUTION. A. R. Anderson and Farhataziz (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Trans. Faraday Soc., 59: 1299-1309(June 1963).

Complete product yields were determined for the Co^{60} γ radiolysis of dichromate ions in 0.8 and 0.08 N sulfuric acid, and it is shown that the kinetics depend on the relative concentrations of acid anion, hydrogen, and chromic ions. The role of hydrogen probably accounts for previously reported discrepancies in the dichromate reduction yield. The experimental data are quantitatively interpreted by the assumption that while OH radicals react with HSO_4^-, hydrogen, and chromic ions, the reaction of HSO_4 radical with hydrogen is so slow that it can be neglected. Relative rate constants, $k_{(H_2+OH)}/k_{(HSO_4^-+OH)} = 257, k_{(H_2+OH)}/k_{(Cr^{3+}+OH)} = 119$, were determined and combined with other data to derive absolute rate constants. (auth)

27467 POLYMERIZATION OF ACRYLONITRILE IN N,N-DIMETHYLFORMAMIDE INDUCED BY ^{60}Coγ-RADIATION: EFFECT OF FERRIC CHLORIDE. N. Colebourne, E. Collinson, D. J. Currie, and F. S. Dainton (Univ. of Leeds, Eng.). Trans. Faraday Soc., 59: 1357-68(June 1963).

For the radioinduced polymerization of dilute solutions of acrylonitrile in N,N-dimethylformamide the rate of polymerization is proportional to $[monomer]^{1.24}$ $dose\text{-}rate^{0.60}$. The kinetics of the reaction are discussed in terms of either termination by primary radicals or degradative solvent transfer. Polymerization in solutions containing ferric chloride shows that the substance terminates the growth of polyacrylonitrile radicals and also the existence of a competitive reaction between the solute and acrylonitrile for the primary radicals. As the dose-rate exponent for the reaction increases from 0.60 to 1.0 with increasing ferric chloride concentration, the monomer exponent increases from 1.24 to a limiting value of 1.40. The values (l $mole^{-1}$ sec^{-1}) at 25°C of the rate constants are: propagation, $(3.8 \pm 2) \times 10^2$; mutual termination, $(4.2 \times 2) \times 10^7$; termination by ferric chloride, $(8 \pm 3) \times 10^2$. (auth)

27468 PHOTOELECTRIC PROPERTIES OF THE ALKALI METAL AZIDES. S. K. Deb (National Research Council, Ottawa). Trans. Faraday Soc., 59: 1414-22(June 1963).

Measurements were made on photoconductivity and photoelectric emission properties of the alkali azides at room temperature in the spectral range 1400–10,000 Å. The result obtained when compared with optical absorption measurements suggests that the photocurrent results from exciton interactions. The effect of x-irradiation on the photoelectric properties was also studied and a glow curve measurement was done on the ultra-violet-irradiated NaN_3 and KN_3 crystals. (auth)

27469 RELAXATION POLARIZATION IN SATURATED HYDROCARBONS IRRADIATED AT LOW TEMPERATURES. E. L. Frankevich and B. S. Yakovlev (Inst. of Physical Chemistry, Academy of Sciences, USSR). Zh. Fiz. Khim., 37: 1106-12(May 1963). (In Russian)

High voltage polarization was revealed in saturated hydrocarbons irradiated at liquid nitrogen temperatures with electrons of 1.6 Mev energy. The compounds studied were heptane, hexane, nonane, decane, undecane, and tetradecane. The nature of the high voltage polarization was investigated by measuring the steady state potential distribution in the specimen, the dependence of the conductivity upon the sample thickness, and the dependence of τ_m upon the crystallinity of the compound. The experimental results led to the assumption of a possible mechanism for the high voltage polarization consisting in a charge redistribution in ions of the type $\ldots CH_2-\overline{C}H-CH_2\ldots$ and $\ldots CH_2-\overset{+}{C}H-CH_2\ldots$. The activation energy of the H^+ or H^- migration in hexane was determined: $U = 0.06 \pm 0.02$ ev. Within the framework of the proposed model the concentration charge of accumulating in saturated hydrocarbons (hexane) at low temperature under the action of 50 Mrad doses was estimated. The value obtained ($2 \cdot 10^{19}$ I/cm^3) shows that the contribution of the reactions of charged particles in radiolysis processes of saturated hydrocarbons can be commensurated with the participation of free radicals. (P.C.H.)

27470 ON THE POLYMERIZATION OF VINYLIDENE FLUORIDE UNDER THE INFLUENCE OF γ-IRRADIATION. E. V. Volkova, A. V. Fokin, A. D. Sorokin, and L. A. Bulygina. Zh. Vses. Khim. Obshchestva im. D. I. Mendeleeva, 7: 593-4(1962).

Radioinduced polymerization in bulk of vinylidene fluoride was investigated and the results compared with previous studies carried out with tetrafluoroethylene and trifluorochlorethylene. The rate of radiative polymerization under the same conditions is tetrafluoroethylene > vinylidene fluoride > trifluorochlorethylene and the corresponding yields per 100 ev are 10^6, 10^5, and 10^4 molecules, respectively. Polymerization occurs in all cases with a high conversion rate, practically up to 100%. A considerable induction period, effected by impurities (especially oxygen), was observed and, therefore, the monomer was purified before use. The latter was a commercial grade of 99.8% purity. The dependence of the conversion upon irradiation time was studied at 23°C with doses of 1, 5, 10, and 30 rad/sec and the rate of reaction determined from the inclination of the kinetic curves. The value of the radiation-chemical yield decreases with the dose capacity. An increase in temperature raises the rate of the radiation polymerization, but for all investigated temperatures (–78, –20, 0, 23°C at 10 rad/sec) a maximum value was obtained after about 6 hr. The total activation energy of radiative vinylidene fluoride polymerization was determined with 3.6 kcal/mole. The process occurs by a radical-chain mechanism. (OTS)

27471 THE KINETICS OF VINYL ACETATE POLYMERIZATION AT LOW TEMPERATURE BY Co^{60} GAMMA RADIATION. H. A. Dieu, J. L. Orbiso, and V. Desreux (Université, Liège). IAEA Preprint CN-14/10. 18p. (In French)

To be published in Proceedings of the IAEA Conference on the Application of Large Radiation Sources in Industry, Salzburg, Austria, May 1963.

Using the dilatometric technique, the polymerization of vinyl acetate in block form and liquid by gamma irradiation

from a 150C Co^{60} source was studied at temperatures from 25 to −40°C. After careful purification and prepolymerization by gamma irradiation in vacuo at 20°C, the monomer was distilled into the dilatometer, with or without some of the initiator, α,α′-azobisisobutyronitrile. Polymerization by gamma irradiation was carried out in a methyl alcohol thermostat set at ±0.05°C. The order of the reaction was first tested in relation to irradiation intensity at 0 and −40°C in the absence and presence of the initiator (concentration 256×10^{-4} mole/l). At a low dose rate (at least below 80 rads/min), the intensity index is around 0.5; at higher intensities (some 500 rads/min), it tends to fall to zero. The variation in reaction velocity with initiator concentration was studied next at 25, 0, −10, −25, −32, and −40°C. Taking into account the square of the polymerization velocity in the absence of the initiator, the square of the total polymerization velocity in the presence of the initiator is a function of initiator concentration to the power of 0.66. (auth)

27472 RADIATION CHEMISTRY OF AMMONIA: SYNTHESIS OF HYDRAZINE. J. R. Puig and E. Schwarz (Centre d'Etudes Nucléaires, Saclay, France). IAEA Preprint CN-14/2. 49p. (In French)

To be published in Proceedings of the IAEA Conference on the Application of Large Radiation Sources in Industry, Salzburg, Austria, May 1963.

The radiation chemistry of ammonia, pure or with various additives, was studied by Co^{60} gamma radiation. The kinetics of aniline formation by the irradiation of homogeneous benzene–ammonia mixtures was determined together with the kinetics of hydrazine formation in the case of pure ammonia. The effects of dose, intensity, temperature, and specific additives were determined. (auth)

27473 RADIOCHEMICAL SYNTHESIS OF COMPOUNDS OF BIOLOGICAL INTEREST. F. Balestic (Centre d'Etudes Nucléaires, Saclay, France). IAEA Preprint CN-14/1. 11p. (In French)

To be published in Proceedings of the IAEA Conference on the Application of Large Radiation Sources in Industry, Salzburg, Austria, May 1963.

Cobalt-60 gamma irradiation of solid state ergosterol in vacuo loads to the formation of precalciferol at a temperature of 20°C. The maximum radiochemical yield observed is equivalent to 8 for one delivered dose of 46×10^{18} ev/g. Thereafter the yield diminishes, mainly forming suprasterols. Co^{60} gamma irradiation of concentrated aqueous solutions of ammonium acetate gives glycine and aspartic acid. The study covered the effects of dose, irradiation intensity, ammonium acetate concentration, temperature, and pH on energy yield (amino acids). (auth)

27474 SOLID-STATE POLYMERIZATION OF PHOSPHONITRILIC CHLORIDE. V. Caglioti, D. Cordischi, A. Mele, and P. Porta (Comitato Nazionale per l'Enérgia Nucleare, Rome and Università, Rome). IAEA Preprint CN-14/31. 12p. (In English)

To be published in Proceedings of the IAEA Conference on the Application of Large Radiation Sources in Industry, Salzburg, Austria, May 1963).

The radioinduced polymerization of phosphonitrilic chlorides was investigated. Trimeric phosphonitrilic chloride polymerizes when irradiated in the solid state by using γ rays. The tetramer does not polymerize either in the solid or in the liquid state. The rate of polymerization of the trimer increases with temperature up to the melting point. Above this temperature it decreases almost to zero. The polymerization rate is influenced by the presence of oxygen, the purity of the material, and the size of the crystals. The structure of the solid seems to be the determining factor for the polymerizability of the trimer. X-ray-diffraction diagrams on a single crystal in various stages of polymerization were examined. (auth)

27475 INVESTIGATIONS ON THE RADIATION PRODUCED PEROXIDES OF POLIMETHYLMETHACRYLATE (PMM) AND PMM COPOLYMERS. S. Polowinski, E. Turska, and J. Kroh (Politechnika, Lodz, Poland). IAEA Preprint CN-14/39. 8p. (In English)

To be published in Proceedings of the IAEA Conference on the Application of Large Radiation Sources in Industry, Salzburg, Austria, May 1963.

The influence of Co^{60} γ-radiation dose on the yield of peroxides during the irradiation of powdered polymethylmethacrylate (PMM) in the presence of air was investigated. The dependence of peroxide concentration on the size of PMM grain and oxygen concentration was also determined. In order to explain the effect of shielding groups and the significance of their distribution on the peroxide formation, analogous experiments were carried out with PMM + styrene copolymers of varying composition and structure. Ordinary, statistic copolymers, grafted copolymers, and block copolymers were subjected to gamma irradiation. An attempt was made to formulate general conclusions on the basis of experimental results. (auth)

27476 RADIATION-INDUCED COPOLYMERIZATIONS OF OLEFINE MONOMERS WITH TETRAFLUOROETHYLENE. Y. Tabata, K. Ishigure, H. Shibano, K. Oshima, and H. Sobue (Tokyo Univ.). IAEA Preprint CN-14/46. 20p. (In English)

To be published in Proceedings of the IAEA Conference on the Application of Large Radiatfon Sources in Industry, Salzburg, Austria, May 1963.

The radioinduced copolymerization of olefin monomers with tetrafluoroethylene is described. In the cases of ethylene and propylene, the composition of copolymers obtained varied continuously with molar concentration of the components in the monomer mixture, and their melting point varied continuously in the range between the melting points of the composing homopolymers. In the case of isobutene, the composition of copolymer remained constant with the ratio of one to one (alternating copolymer) irrespective of the change in concentration of the components in the monomer mixture and its melting point remained constant (about 200°C). The copolymers of tetrafluoroethylene–ethylene and tetrafluoroethylene–isobutene show high crystallinity. It was concluded that all the copolymerizations proceed by a radical mechanism. The monomer reactivity ratio of the systems was determined. (P.C.H.)

27477 RADIATION POLYMERIZATION OF ACETYLENE HYDROCARBONS: SPECIAL FEATURES. I. M. Barkalov, V. I. Goldanskii, and Min-Kao Kuo. IAEA Preprint CN-14/65. 20p. (In Russian)

To be published in Proceedings of the IAEA Conference on the Application of Large Radiation Sources in Industry, Salzburg, Austria, May 1963.

The kinetics of the radiation polymerization of ethynylbenzene and other acetylene derivatives have a number of features typical of ion polymerization quite rare in radical polymerization (speed of polymerization linearly proportional to speed of initiation; very low activation energy; no oxygen inhibition). Nevertheless the polymerization is obviously radical. This was concluded on the basis of a study of polymerization initiation for acetylenic hydro-

carbons by typical radical initiators—benzoyl peroxide and the dinitrile of azoisobutyric acid. Investigations were also made on the kinetic features and mechanism of peroxide decomposition in the presence of acetylenic hydrocarbons (ethynylbenzene, ethynylbenzene-d, and phenylpropyne). The kinetics of radiation copolymerization of ethynylbenzene with different vinyl monomers and the composition of copolymers in different initial mixtures were also studied. These data and the results of a study of the kinetics of inhibited ethynylbenzene polymerization (benzoquinone initiator) indicate a small reactivity capacity of the ethynylbenzene radical. The pronounced deviations from the additivity rule in the case of radiation polymerization in different solvents indicate a large energy transfer to acetylenic hydrocarbons and their polymers. (P.C.H.)

27478 POLYMERIZATION OF ETHYLENE IN AQUEOUS SILVER SALT SOLUTION BY COBALT-60 GAMMA RADIATION. S. Roesinger and St. Muellner (Farbwerke Hoechst AG, Ger.). IAEA Preprint CN-14/56. 17p.

To be published in Proceedings of the IAEA Conference on the Application of Large Radiation Sources in Industry, Salzburg, Austria, May 1963.

Ethylene, ethylene–propylene mixtures, and propylene polymerize on irradiation in aqueous Ag salt solution under moderate pressures. Propylene formed oils or waxes, and ethylene yielded solid polymers of high molecular weight. The yields obtained exceeded 25 polyethylene/l/hr. With a dose rate of 7.1×10^3 rad/hr this corresponds to a G-value (number of molecules reacted per 100 ev of energy absorbed) of 0.6×10^5. The polymer formation goes up with increasing ethylene pressure and increasing Ag salt concentration. The Ag salt solution can be re-used without a decrease in yield. The reaction is inhibited by traces of oxygen. The polymer yield is proportional to the absorbed dose, if the dose rate is kept constant. The variation of yield with dose rate J equals $J^{0.5-0.6}$. The optimum temperature range is 20 and 30°C. Below 0°C the reaction is almost nil. The stirring velocity does not influence the yield. The density of the products is about 0.94 g/cm^3; melting points between 126 and 131°C were observed. Infrared absorption studies gave no evidence for C=C double bonds, C–O–H or C=O groupings; a small number of C–O–C bonds were detected. The content of methyl groups is 0.3%. The polymers are probably long chain branched and show viscosities between 5 and 10. (auth)

27479 RADIOLYSIS OF METHANE IN AN ATOMIC REACTOR. S. Ionescu, V. Dumitrescu, E. Gârd, E. Sofrone, and D. Stoian (Institutul de Fizică Atomică, Bucharest). IAEA Preprint CN-14/58. 11p. (In Russian)

To be published in Proceedings of the IAEA Conference on the Application of Large Radiation Sources in Industry, Salzburg, Austria, May 1963.

The radiolysis of methane was carried out by particles that produce denser ionization than x, gamma, or electron radiation, but less dense than fission fragments. A reactor was used as the source of radiation. Pure methane was passed through Li_2CO_3, which, when irradiated by slow neutrons, produced α particles with an energy of 2.2 Mev and recoil tritons of 2.7 Mev on the basis of the reaction $Li^6 (n,\alpha) H^3$. It was found that the spectrum of radiolysis products does not depend on radiation denstiy of ionization. The same products were found in the case of neutron, gamma, and α irradiation. Hydrocarbons with C_2 were not found. (P.C.H.)

27480 RECENT ACHIEVEMENTS IN THE RADIATION-CATALYZED CHLORINATION OF CHLORINATED PENTANE DERIVATIVES. A. Almásy and V. Rőna (Nehezvegyipari Kutató Intézet, Veszprém, Hungary). IAEA Preprint CN-14/52. 11p. (In English)

To be published in Proceedings of the IAEA Conference on the Application of Large Radiation Sources in Industry, Salzburg, Austria, May 1963.

Investigations were made on how and to what extent the yield of octachlorocyclopentene is affected by additional chlorination of pentane, previously chlorinated under cooling (at 10 to 30°C). Experiments were carried out with a Co^{60} radiation source of 330 C at a dosage rate of 8×10^3 to 8×10^4 r/hour, in a heated reaction mixture, mixed with a Cl stream for periods not exceeding 30 hr. It was found that this type of chlorination and cyclization takes place at a temperature substantially lower than the conventional 500 to 600°C. It was necessary to raise the initial temperature of 170° of the reaction gradually to 220° with the progress of the reaction, in order to promote the cyclization reaction. It was found that first the paraffin chain was further chlorinated and later the perchlorinated pentane derivatives cyclize partly to octachlorocyclopentene, with formation of other chlorinated alkane and alkene derivatives. This reaction mechanism was also supported by thermodynamic calculations. The end product contains three main components; its content of octachlorocyclopentene ranges from 25 to 35 per cent. (P.C.H.)

27481 RADIATION SYNTHESIS OF STANNOUS DIBROMODIBUTYL. L. V. Abramova, I. V. Vereshchinskii, K. A. Kocheshkov, V. Yu. Miretskii, V. V. Pozdeev, Yu. S. Ryabukhin, and N. I. Sheverdina. IAEA Preprint CN-14/59. 8p. (In Russian)

To be published in proceedings of IAEA Conference on the Application of Large Sources in Industry, Salzburg, Austria, May 1963.

An experiment was carried out in order to discover the effects of a number of factors on the irradiation synthesis velocity of stannous organic compounds in a stannous dibromodibutyl sample. For this purpose a special device with periodic loading of the components and unloading of the reaction products was designed and manufactured. Its excellent features included thermo-setting, effective mixing, and the periodical selection of test samples for analysis. The main loop (a 2-l stainless steel reaction vessel) was provided with a mixer. The device was mounted on a Co^{60} gamma irradiation source. Experiments were carried out at a temperature of 80 ± 5°C and at atmospheric pressure. The dose intensity amounted to ~50 rad/sec (ferrosulfate dosimeter). Powdered stannous metal and butyl bromide differing in degree of purity were employed. The reactivity components were applied in different ratios. It was established that under these conditions a controlled radiation chemistry reaction takes place, the main result of which is a high yield of stannous dibromodibutyl. The process has an induction period whose duration depends upon the purity of the initial butyl bromide; this has a notable effect on the formation velocity of the end product. It was found that the tin not used in the reaction can be repeatedly used for the purpose of obtaining stannous dibromodibutyl and the induction period entirely eliminated. A reaction mechanism is proposed to explain the principles of the process that gives a substantial irradiation yield. (P.C.H.)

27482 SOME POSSIBILITIES OF RADIATION POLYMERIZATION FROM THE GASEOUS PHASE ON SOLID BASE LAYERS. B. L. Tsetlin. IAEA Preprint CN-14/63. 15p. (In Russian)

To be published in Proceedings of the IAEA Conference

on the Application of Large Radiation Sources in Industry, Salzburg, Austria, May 1963.

The unusual feature of graft polymer synthesis by solid bed irradiation in the presence of monomer vapors is that the activation centers initiating polymerization are in practice generated only on the bed; transmission of the kinetic chain to the monomer is impeded, and new polymer chains grow only under the influence of the solid bed molecular forces. These features of gas phase processes enlarge the scope of the graft polymer technique, making it applicable to inorganic beds and usable in the synthesis of mineral organic products. If stretched synthetic fibers are used as a bed, on the other hand, their orientated macromolecules control the growth of new polymer chains and the graft polymer is oriented in the same way. Two-component combined fibers are formed as a result, and the fiber-bed and grafted fiber may in given circumstances display their own particular complex of mechanical properties. (P.C.H.)

27483 THE EFFECT OF IRRADIATION ON THE ADSORPTION AND CATALYTIC PROPERTIES OF NICKEL. P. Tetenyi, L. Guczi, L. Babernics, and K. Schaechter (National Atomic Energy Commission, Budapest). IAEA Preprint CN-14/53. 23p.

To be published in Proceedings of the IAEA Conference on the Application of Large Radiation Sources in Industry, Salzburg, Austria, May 1963.

The influence of neutron and gamma irradiation on the adsorption of H, the dehydrogenation of cyclohexane and iso-C_3H_7OH, and dehydration of tert-C_4H_9OH on a Ni catalyst was investigated. For the reason of separation of chemical and structural influences on the surface properties (adsorption and catalytic activity) a radioactive Ni catalyst was also investigated. Gamma irradiation caused only structural changes in the catalyst, the microchemical changes were represented by the radioactive Ni; in the case of the neutron irradiated sample both took place. Adsorption isotherms, isosteric heats of H_2-adsorption, and the surface area of the different samples were determined. It was stated that the irradiation (or the preparing of the catalyst from radioactive Ni) did not influence the adsorption heat of H_2 very strongly (by the same surface coverage) but the heterogeneity of the samples changed considerably. The values of virtual activation energy for the above mentioned three catalytic reactions were determined. From these values the bond strengths of H–Ni, C–Ni, and O–Ni were calculated. It was found that irradiation affected the virtual activation energy and that there were some definite changes in the bond strengths of Ni–O. The mean catalytic activity of the samples changed, decreased in some cases, when, as a result of irradiation, radioactive Ni and, consequently, traces of Cu were formed. The catalytic activity of Ni was increased by irradiation with gamma rays. (P.C.H.)

27484 RADIATION POLYMERIZATION IN THE SOLID PHASE. I. M. Barkalov. IAEA Preprint CN-14/64. 34p. (In Russian)

To be published in Proceedings of the IAEA Conference on the Application of Large Radiation Sources in Industry, Salzburg, Austria, May 1963.

Studies on solid phase radiation polymerization kinetics of a number of monomers, using the calorimetric method and an EPR signal, revealed the essential role of the specific radiation reaction during the irradiation. The polymerization process for acrylonitrile (from –196°C to –140°C) and vinyl acetate (–196°C to –100°C) ceases when irradiation is discontinued despite the retention of the shape and intensity of the EPR signal, and of the long lifetime of the irradiation-produced ions. The results indicate the potential role of short-lived excited states in the radiation solid phase polymerization of a number of monomers. Such under-beam polymerization occurs in practice without activation energy, unlike slow post-polymerization, which occurs with the same activation energy as does the liquid phase process. (P.C.H.)

27485 THE ROLE OF FREE RADICALS IN THE RADIATION VULCANIZING OF ELASTOMERS. A. S. Kuzminskii, T. S. Fedoseeva, and V. F. Chertkova. IAEA Preprint CN-14/62. 20p. (In Russian)

To be published in Proceedings of the IAEA Conference on the Application of Large Radiation Sources in Industry, Salzburg, Austria, May 1963.

Studies were made on the mechanism of radiation vulcanization by investigating the recomination processes of free radicals in linear polymers. The recombination processes of the free radicals produced by gamma irradiation were examined in detail in relation to the structural properties of polymers. In highly elastic polymers of the rubber type, characterized by high internal mobility of the chains and low intermolecular bend energy, the actual recombinations of free radicals at temperatures above Tg occur at very high speed. The concentration of radicals in rubber samples, irradiated in liquid nitrogen, diminishes on warming up to +20°C by 1.5 to 2 orders of magnitude. Concentration of the remaining radicals at +20°C in crystallizing and normal rubbers is somewhat higher than the susceptibility boundary for present EPR devices but is lower in amorphous ataxic polymers. This reduction in concentration is caused at temperatures below Tg by the recombination of radicals in the cell but in the region of vitrification temperatures is caused by the increase in the segmental motion of the molecular chains. Establishment of a space network lowers the recombination velocity of radicals on heating and increases their lifetime where T = 20°C. The process of destruction of radicals in cross-linked polybutadiene was studied at a varying degree of cross-linking in the temperature range of –196 to +100°C. It was established that the recombination velocity depends upon the density of the space network, for one and the same number of cross links. (P.C.H.)

27486 PROCESS FOR POLYMERIZING FORMALDEHYDE BY THE ACTION OF IONIZING RADIATION. (to Japanese Assn. for Radiation Research on Polymers). British Patent 928,605. June 12, 1963. Priority date Aug. 15, 1959, Japan.

Subjecting substantially anhydrous liquid formaldehyde to ionizing radiation at a temperature between –30° and –100°C and at a dose rate of 10^2 to 10^8 roentgens per hour produces high-molecular-weight formaldehyde polymers of greater stability and polymerization than is conventionally obtained. (D.C.W.)

Raw Materials and Feed Materials

27487 SOLID SOLUTION FORMATION IN THE $U_3O_8 \rightarrow UO_2$ TRANSFORMATION. S. Marinković ("Boris Kidrich" Inst. of Nuclear Sciences, Belgrade). J. Nucl. Mater., 8: 187-97(Mar.-Apr. 1963). (In English)

Possibilities were investigated for the incorporation of various foreign elements into the crystal lattice of uranium dioxide during its formation in $U_3O_8 \rightarrow UO_2$ transformation. During arc-ignition in various gas environments (A, N_2, CO_2, H_2) of U_3O_8-metal oxide mixtures in a graphite

electrode, under conditions analogous to those of the spectrochemical analysis of uranium, it was found that in the rapid and complete $U_3O_8 \rightarrow UO_2$ transformation thereby made possible, foreign elements present are incorporated to a limited extent into the lattice of the uranium dioxide formed. For specimens arced in N_2, maximum concentrations retained in solid solutions with UO_2 were: 13 mole % CdO; 4 mole % ZnO; 4 mole % MgO; 7 mole % Bi_2O_3; 1 mole % PbO; 0.1–0.4 mole % CaO, In_2O_3, or NiO; ThO_2 and La_2O_3 were not found to enter UO_2 lattice, but arc-ignition of a U_3O_8–$La(NO_3)_3 \cdot 6H_2O$ mixture resulted in ready solid solution formation. On the basis of density measurements of solid solutions containing CdO and ZnO respectively, it was concluded that fluorite-type substitutional solid solutions were formed with intact cation lattice, the anion lattice probably remaining intact as well. For specimens arced in H_2, capacity for solid solution formation is reduced. The factors influencing the behavior of the foreign metal oxides in mixtures with U_3O_8 under investigated conditions are discussed. The possibility of solid solution formation of UO_2 with certain less stable oxides, employing rapid $U_3O_8 \rightarrow UO_2$ transformation, is pointed out. (auth)

27488 SINTERING OF URANIUM DIOXIDE IN AN ATMOSPHERE OF CONTROLLED HYDROGEN CONTENT. A. J. Carrea (National Atomic Energy Commission, Buenos Aires). J. Nucl. Mater., 8: 275-7(Mar.-Apr. 1963). (In English)

For UO_2 powders not fired above 800°C during reduction, with a BET surface around 5–6 m^2/g and a O/U ratio (stored in air) between 2.13 and 2.20, the standard nuclear requirements (95% crystallographic density or more, density dispersion less than 2%, open porosity below 1%, composition stoichiometric) were achieved by the Ar + 3% vol H_2 cycle with a maximum sintering temperature of 1200°C. Results obtained with the cycle were superior to any obtained with a hydrogen-only cycle up to 1700°C, for this type of powder. (P.C.H.)

27489 HOW SWEDEN IS DEVELOPING ITS LOW GRADE U_3O_8. Olaf Hormander and Ragnar Gelin (Aktiebolaget Atomenergi, Stockholm). World Mining, 16: 28-31(Mar. 1963).

Uranium mining and processing at Ranstad, Sweden, are described. Mine development and mill construction are scheduled for full production in 1965. The U is extracted by ion exchange; the concentrate produced contains 84% U_3O_8. The complete cycle of processes is illustrated by flowsheets. (Uranium Abstr., Vol. 2, No. 4, May 1963)

27490 THE PRODUCTION OF HEAVY METALS, URANIUM IN PARTICULAR, FROM LOW-GRADE ORES WITH THE AID OF CHLORINE GAS. Walther Kangro (Technische Hochschule, Braunschweig, Ger.). Z. Erzbergbau Metallhuettenw., 16: 107-12(Mar. 1963). (In German)

The general conditions under which metal oxides can be volatilized at high temperatures in the form of chlorine compounds using only chlorine gas are discussed. The equilibria of uranium oxides with chlorine at high temperatures are dealt with, and measurements of the equilibria briefly described. The chlorination of uranium oxides can be carried out only above 1000°C at efficient rates and with efficient utilization of chlorine. The additional external heat required for reaction and vaporization of UO_2Cl_2 comes to about 92 kcal/kg U in the mixed oxides. Further processing of the metal chlorine compounds to metal and the possibility of reclaiming the chlorine are briefly discussed. It is then pointed out that the chlorination process makes it possible to win all metals present in the ore, including Fe, in a high-value form, and thereby to make economical the processing of very low-grade ores. (Uranium Abstr., Vol. 2, No. 4, May 1963)

27491 METHOD OF PROCESSING URANIUM ORE. (to Commissariat a l'Energie Atomique). British Patent 928,889. June 19, 1963. Priority date Aug. 14, 1958, France.

A method is given for obtaining starting precipitates with higher U contents from sulfuric acid leach solutions of poor-grade U ores. The method comprises neutralizing the leach solution with $Ca(OH)_2$ to form a starting precipitate, separating the precipitate from the solution, adding to the precipitate sufficient H_2SO_4, $FeSO_4$, or $Fe_2(SO_4)_3$ to react completely with the U, Mn, Cu, and Al in the precipitate, calcining the mixture at 100 to 400°C, and adding $Ca(NO_3)_2$ solution to the calcined mixture to obtain a $UO_2(NO_3)_2$ solution. The formation of the starting precipitate may be carried out in two steps (to pH 2.7 and then to pH 7) to increase the U content. (D.L.C.)

Separation Processes

Refer also to abstracts 28461, 28463, 28464, 28465, 28469, and 28580.

27492 (BNL-791) AXIAL MIXING AND MASS TRANSFER IN FUSED SALT–LIQUID METAL EXTRACTION COLUMNS. F. B. Hill and L. E. Kukacka, Jr. (Brookhaven National Lab., Upton, N. Y.). Jan. 1963. Contract AT-30-2-GEN-16. 21p. (BNL-T-301)

A brief experimental study of rate processes important in the performance of fused salt–liquid metal extraction columns was carried out. Bi and the NaCl–KCl–$MgCl_2$ eutectic were the two liquid phases. Experiments on axial mixing and on interphase mass transfer were carried out at 500°C in a disk-and-doughnut column having an active section 4 in. in ID and 42.5 in. long. Interpretation of Na^{24}-tracer break-through experiments led to an active-section continuous salt-phase Peclet number for axial mixing of ≈5, independent of the ratio of the two superficial mass velocities in the ranges 25000 to 98000 lb Bi/hr-ft^2 and 1800 to 10000 lb salt/hr-ft^2. Mixing corresponding to the value of the Peclet number appeared to have little effect in the mass transfer experiments, which were performed by using the exchange reaction involving Ce and Mg. Ce was reduced from salt into Bi in a series of experiments in which the concentration of Mg in Bi was gradually increased from ≈10 to 50 ppm, and the two superficial mass velocities were varied from 21000 to 79000 lb Bi/hr-ft^2 and 1600 to 9300 lb salt/hr-ft^2. Over-all volumetric mass transfer coefficients for Ce based on salt-phase concentrations ranged from 15 to 100 lb Ce/hr-ft^3 (lb Ce/lb salt). Estimates of the area mass transfer coefficients based on the salt varied strongly with the equilibrium distribution coefficient as expected on the basis of a two-film theory of mass transfer. Data from a single mass transfer experiment involving a 2-in.-ID by 42.5-in.-long column packed with ¼-in. stainless steel spheres are also reported. (auth)

27493 (WCAP-3716) ION EXCHANGE IN BORIC ACID SOLUTIONS WITH RADIOACTIVE DECAY. W. D. Fletcher (Westinghouse Electric Corp. Atomic Power Div., Pittsburgh). Nov. 1962. Contract AT(30-1)-3064. 87p.

Ion-exchange processes, in the presence of macroconcentrations of boric acid (1000 ppm B) and potassium hydroxide (~10^{-4} M K), were evaluated for cesium, man-

ganese, cobalt, and iodide ions. It was found that efficient ion exchange of either cation or halogen anion contaminants in boric acid solution may be accomplished using a mixed-bed resin in the potassium (or hydrogen)–borate form. Mass transfer coefficients were determined for the ions for use in predicting the performance of deep ion-exchange beds in dynamic systems. Equations for bed performance were developed for the nuclear system. Ion-exchange equilibrium constants were determined for the ions in boric acid solution, with and without added potassium. Also, ion-exchange equilibrium quotients were determined for borate ion and potassium. (auth)

27494 LIQUID-LIQUID EXTRACTION OF PERTECHNETATE ION WITH METHYLTRICAPRYLAMMONIUM CHLORIDE. G. B. S. Salaria, Charles L. Rulfs, and Philip J. Elving (Univ. of Michigan, Ann Arbor). Anal. Chem., 35: 983-5(July 1963).

Liquid-liquid extraction with a chloroform solution of methyltricaprylammonium chloride results in the quantitative isolation of pertechnetate ion from aqueous media, ranging from 4M sulfuric acid or 9M hydrochloric acid to pH 13. The specificity of the separation is indicated by the report that a similar type of extraction results in a highly selective separation of perrhenate from ions of most other elements. The formation of a 1 : 1 pertechnetate–organic cation adduct appears to be requisite for the extraction at any pH; an excess of the organic reagent is only necessary where extraneous anions can compete with the pertechnetate ion. The competition of chloride ion in the liquid-liquid anion exchange system involved was studied. (auth)

27495 SEPARATION OF RADIOACTIVE IODINE IN HIGH PURITY FORM FROM RADIOACTIVE TELLURIUM BY MEANS OF COLUMN CHROMATOGRAPHY. N. Getoff and W. Parker (Inst. for Radium Research and Nuclear Physics, Vienna). Atompraxis, 9: 175-7(May 1963). (In English)

The radiochemical separation of iodine-131 from tellurium by means of column chromatography is described. Initial studies were carried out using the technique of ascending paper chromatography and the results obtained applied to column chromatography. Using the method described presents the possibility of separating large quantities of extremely pure radioactive iodine. Both chemical analysis, and nuclear spectroscopic studies, were employed in order to check the degree of purity obtainable. The principal advantage of the reported method is that the materials made use of, for the separation, are unlikely to be subject to radiation damage. Thus high levels of activity can be processed. (auth)

27496 TITANIUM EVAPORATOR FOR URANIUM AND PLUTONIUM LIQUORS. John Lindley (United Kingdom Atomic Energy Authority, Caithness, Scotland). Brit. Chem. Eng., 8: 397-400(June 1963).

The evaporation of plutonium or enriched uranium liquor presents some unusual problems in equipment design and operation. Data are presented on the performance of an evaporator constructed in titanium and manufactured for the specific purpose of evaporating uranium and plutonium solutions resulting from a solvent extraction process. The high rate of liquor circulation at the designed boil-up rate of 10 l/hr resulted in an overall heat transfer coefficient in the region of 280 Btu/hr ft^2°F for a concentrated uranium solution. (auth)

27497 A SPECTROPHOTOMETRIC INVESTIGATION OF THE SYNERGIC SOLVENT EXTRACTION SYSTEM URANYL ION/TRI-(n-OCTYL) PHOSPHINE OXIDE (TOPO)/DI(2-ETHYLHEXYL) PHOSPHORIC ACID (D2EHPA). H. Ihle, H. Michael, and A. Murrenhoff (Universität, Bonn). J. Inorg. Nucl. Chem., 25: 734-6(June 1963).

For the system uranyl ion/tri(n-octyl) phosphine oxide (TOPO)/excess di(2-ethylhexyl) phosphoric acid (D2EHPA) in kerosene the ratio TOPO : U in the complex formed was investigated spectrophotometrically using the method of continuous variations. Three mechanisms for the formation of the UO_2^{2+}/D2EHPA/TOPO complex are considered, and it is demonstrated that the method of continuous variations is suitable for the determination of the ratio TOPO : U. Measurements were made between 3900 and 4500 Å. (C.E.S.)

27498 THE INFLUENCE OF PHASE TRANSFER DISCONTINUITY ON THE EFFICIENCY OF INTERMITTENTLY PULSED LIQUID-LIQUID COUNTERCURRENT EXTRACTION COLUMNS. R. Kiessling (Institut für Physikalische Stofftrennung der DAdW, Leipzig). Kernenergie, 6: 168-72 (Apr. 1963). (In German)

Intermittent pulse forms corresponding to mixer-settler principles allowed spray-laminated columns to be developed for liquid-liquid countercurrent extraction with theoretical cell efficiency up to 200%. The reason for that is the discontinuity of the phase transports by which a maximum of two equilibria occurs between the phases during a pulsation cycle. Therefore, the positive influence of this effect depends strongly on the size of the distribution coefficient or separation factor, which is shown by theoretical analyses and diagrams. A transfer of the obtained results into practice is to a certain degree possible. An experimental proof was given previously. (tr-auth)

27499 LABORATORY STUDY ON THE CHLORINATION REPROCESSING OF NEUTRON-IRRADIATED URANIUM FUELS. 4. PRODUCTION AND PROPERTIES OF ZIRCONIUM-PHOSPHATE-SILICATE EXCHANGE MATERIAL AND ITS APPLICATION FOR PLUTONIUM ISOLATION. D. Naumann (Zentralinstitut für Kernphysik, Rossendorf, Ger.). Kernenergie, 6: 173-6(Apr. 1963). (In German)

For the separation of plutonium from fission products, large amounts of radiation-resistant exchangers are necessary. Synthetic inorganic exchangers were prepared with zirconium phosphate silicate (ZPS) as the base. The characterization of their exchange properties yielded capacity values of 2.5 milliequivalents per gram at pH 7. They possess especially favorable separation properties for plutonium. Therefore, the ZPS was inserted for plutonium isolation after the chlorination of irradiated UO_2 and the gas-chromatographic separation of chloride vapors (700°C) on charcoal. For plutonium in a single passage on ZPS a total separation factor of 0.6×10^3 was obtained, which can be improved by further operations. (tr-auth)

27500 ADSORPTION INVESTIGATIONS IN NITRATE FUSES. D. Naumann and G. Tschirne (Zentralinstitut für Kernphysik, Rossendorf, Ger.). Kernenergie, 6: 181(Apr. 1963). (In German)

A series of investigations was carried out on adsorber materials for rare earths and uranium to test their suitability for cation-exchange processes in nitrate melts. The adsorption materials studied included ZrO_2–SiO_2, Na_2O–Al_2O_3–SiO_2, Al_2O_3, SiO_2, and $Zr_3(PO_4)_2$. Exchange ratios varied from 1 to 103. (M.C.G.)

27501 MIXER-SETTLER FOR EXTRACTION EXPERIMENTS. W. Ochsenfeld and S. Krawczynski (Kernreaktor Bau- und Betriebs-GmbH, Karlsruhe, Ger.). Kerntechnik, 5: 218-21(May 1963). (In German)

Investigations of extractions conducted in mixer-settlers with di-n-butylether and tributylphosphate led to improve-

ments in mixer design. The extraction apparatus may be applied effectively in laboratory work on small charges and widely variable volume conditions of solution. (auth)

27502 BORON PERMITS LARGER REPROCESSING VESSELS. M. E. Weech (Phillips Petroleum Co., Idaho Falls, Idaho). Nucleonics, 21: No. 7, 70-1(July 1963).

Use of boron–stainless-steel plates inside process equipment permits construction of larger fuel reprocessing facilities without creating critical conditions. Some specific applications are mentioned; design factors (particularly, calculation of critical conditions) are discussed; tests on boron-stainless steel structures are reported; and cost estimates are given. (D.C.W.)

27503 ANION EXCHANGE OF URANIUM AND THORIUM IN KETONE MEDIA. S. Urubay (Universität, Vienna), G. E. Janauer, and J. Korkisch. Z. Anal. Chem., 193: 165-71 (1963).

The adsorption behavior of U and Th was investigated on the strongly basic anion exchange resin Dowex 1 in ketone media containing HCl or HNO_3. Two methods for the separation of U from Th in acetone solution were developed. (TCO)

ENGINEERING AND EQUIPMENT

General and Miscellaneous

Refer also to abstracts 28072, 28362, and 28462.

27504 (EUR-7.f) UTILISATION DES EXPLOSIONS NUCLEAIRES A DES TRAVAUX DE GENIE CIVIL (EXCAVATIONS ET TERRASSEMENTS). (Nuclear Explosions Applied to Civil Engineering Work (Excavations and Earthworks)). P. Herrinck (European Atomic Energy Community). May 1962. 26p.

Information on the cost of nuclear devices and of American and Russian experimental excavations produced by nuclear and chemical explosions is given. The state of technological knowledge in this field is reviewed. The problem of nuclear fallout is examined. A method by which the use of nuclear explosions could perhaps produce excavations without radioactive fallout is proposed. (auth)

27505 (EUR-16.f) POSSIBILITÉS D'UTILISATION PROGRESSIVE DE L'ÉNERGIE THERMIQUE LIBÉRÉE PAR DES EXPLOSIONS NUCLÉAIRES. (Possibilities of Gradual Use of the Thermal Energy Produced by Nuclear Explosions). P. Herrinck (European Atomic Energy Community). June 1962. 40p.

The recovery of the energy output from explosions carried out either underground or in appropriate containers and the use of nuclear explosions for the recovery of geothermal energy are examined. (auth)

27506 (NP-12906) PERFORMANCE OF LUBRICANTS AND THERMAL CONTROL MATERIALS UNDER SIMULATED SPACE CONDITIONS. R. E. Mauri (Lockheed Missiles & Space Co., Palo Alto, Calif.). [nd]. 22p.

The gross effects of space environment on typical materials for spacecraft applications are discussed. Equipment and experimental procedures used for testing and selecting materials in support of a typical high-reliability satellite hardware program are described. Principal material problem areas associated with this program are lubricants for mechanisms and thermal control materials. Experimental details and results on the effect of high vacuum and operating conditions on oils, greases, and dry-film lubricants for bearings are presented. Also discussed are applications of thermal control materials and results of environmental testing of solar reflectors such as white paints in the presence of intense ultraviolet radiation in vacuum. (auth)

27507 (ORNL-3449) PUMP LOOPS USED FOR MATERIALS TESTING IN HIGH TEMPERATURE AQUEOUS SOLUTIONS AND SLURRIES. H. C. Savage (Oak Ridge National Lab., Tenn.). June 24, 1963. Contract W-7405-eng-26. 50p.

Pump loops designed to operate at temperatures and pressures to 320°C and 2000 psia are described. The loops were used to circulate uranyl sulfate solutions and aqueous thoria slurries in out-of-pile tests for the aqueous homogeneous reactor program. As this phase of the aqueous homogeneous reactor program was completed, the loops were converted for use in studies of materials of interest to other types of reactors. Solutions or slurries are circulated in the loops by means of a 100-gpm canned-motor centrifugal pump. The loop piping is of 1- or 1½-in. size and pressurizers of 4-in. pipe are used where required for steam pressurization. Two of the loops were constructed of commercially pure titanium while all others were of type 347 stainless steel. Some loops are hydraulically pressurized by means of a feed pump and letdown valve arrangement. The nominal volumes of the 15 loops, which were constructed varies between 10 and 30 liters, and each loop was designed to contain a large number of corrosion test specimens of various types for exposure under a wide range of conditions. Each loop test was usually of 200 to 500 hr duration, but some tests were operated continuously for more than 7,000 hr. Operating experience covering more than 350,000 hr of accumulated operating time in many hundreds of individual test runs is discussed. The pump loops described proved to be highly satisfactory systems in which to study reactor materials under a wide range of conditions which can be closely controlled to simulate those existing in nuclear reactors. (auth)

27508 (SCTM-59-63(25)) STRESS DETECTION BY INFRARED INSPECTION. Experimental Data Report. L. J. Klamerus and J. C. Dresser (Sandia Corp., Albuquerque, N. Mex.). Mar. 1963. Contract [AT(29-1)-789]. 60p.

Experimental results of the infrared stress-detection study are described. The purpose of the study was to determine the feasibility of identifying areas of excessive stress in complex parts undergoing flexural stressing (as in vibration testing) by detecting the infrared radiation given off from the stressed area. A feasibility test program was undertaken on the basis of the preliminary study to determine the thermal behavior of typical stressed parts. Test data were obtained from cantilever test beams made of aluminum, steel, copper, and cast iron. However, the test data obtained thus far, indicate that the temperature rise at stressed locations is neither significant enough nor consistent enough to be a reliable indication of highly stressed locations in common engineering materials. (auth)

27509 (TID-18844) [SHAPE—IBM 1620 FORTRAN LANGUAGE COMPUTER PROGRAM]. Jim N. Rogers (Sandia Corp., Albuquerque, N. Mex.). [May 1963]. Contract [AT(29-1)-789]. 34p. (SCDC-2047)

The computer program SHAPE, in Fortran for the IBM-1620, was originally developed to describe to a computer the path a numerically-controlled machine tool should follow in cutting a part. It has other uses, particularly in preparing engineering drawings or specifications, in situations where the input is in terms of intersections of geometrical figures and the results are coordinates for defining complex shapes. The SHAPE language is described; its use is illustrated; and examples are given. (D.C.W.)

27510 (TID-18924) THE APPLICATION OF GAS-LUBRICATED BEARINGS TO HIGH-SPEED, TURBOMACHINERY. Quarterly Technical Report, December 1, 1962 to February 28, 1963. J. G. Hinkle, E. J. Gunter, and D. D. Fuller (Franklin Inst. Labs. for Research and Development, Philadelphia). Contract AT(30-1)-2512. 70p. (Q-A2392-3-8)

Studies were made on the design and analysis of both self-acting and externally-pressurized gas-lubricated bearings. A review of the theoretical and experimental work performed on a self-acting, gas bearing rotor is presented. The four-inch diameter rotor was tested at speeds up to

20000 rpm. Hydrodynamic film thickness measurements of the self-acting pivoted shoes were obtained for several conditions of shoe load and various equivalent pivot positions at the design speed of 18000 rpm. An observation of apparent half-frequency whirl instability is presented and discussed. Preliminary test data are presented on the large aspect ratio shoes, L/B = 1.5. Experimental data are shown for tests performed with the small aspect ratio self-acting shoes, L/B = 1.0, which were externally-pressurized at the pivot location during start-up and at low rotational speeds. A discussion of the advantages of this type of bearing arrangement is given. (P.C.H.)

27511 (WAPD-R(WB)-2) A COMPUTER PROGRAM FOR ANALYZING PRESSURE PIPING SYSTEMS. R. E. Kropp (Westinghouse Electric Corp. Bettis Atomic Power Lab., Pittsburgh). Mar. 1963. Contract AT(11-1)-Gen-14. 7p.

The computer program, M0236, for calculating minimum requirements for pressure piping systems as prescribed by the American Standards Association is described. Either minimum thickness of pipe wall at different pressures or maximum internal service pressures for different wall thicknesses are calculated. A subroutine determines the machine time involved in the calculations. (auth)

27512 A LARGE WORKING CHAMBER FOR THE USE OF β-EMITTERS. U. O. Schanze. Atompraxis, 9: 197-8 (May 1963). (In German)

A special designed experimental chamber for the use of beta emitting radioisotopes is described, which is completely constructed of rigid plastics. All manipulations with pure beta emitters even such of high activity and energy can be done. The "Beta Cave" is designed as a double chamber and fitted with all necessary installations. (auth)

27513 A VERSATILE COBALT-60 IRRADIATION FACILITY. Michio Endo, Masatsune Kondo, and Toshifumi Saigusa (Sumitomo Atomic Energy Industries, Ltd., Takarazuka, Eng.). Bull. Inst. Chem. Res., Kyoto Univ., 41: 89-96(Mar. 1963). (In English)

A new versatile Co^{60} gamma-ray irradiation facility was recently installed at the Takarazuka Radiation Laboratory of the Sumitomo Atomic Industries Ltd. in Takarazuka. This facility, being capable of storing about two kilocuries of Co^{60}, was designed and built with versatility for many research purposes. The whole unit is constructed in a hot cave with a viewing window of shielding glass and a couple of manipulators. The radiation dose for the sample to be irradiated and placed at a fixed position can be easily changeable by replacing the source pencil in the cage with the other ones. The experimental and theoretical estimation of the dose rate distribution around the source and in the labyrinth of the hot cave was carried out. Some features of the facility as well as the results of the dose rate estimation are described. (auth)

27514 A CONTROLLED ATMOSPHERE CHAMBER. Charles L. Gordon and Rolf B. Johannesen. J. Res. Natl. Bur. Std., 67A: 269-71(May-June 1963).

An inert atmosphere chamber for the transfer of reactive materials is described. It has the advantages of being inexpensive, easily cleaned, and can be evacuated. (auth)

27515 VERNEUIL CRYSTAL GROWTH IN THE ARC-IMAGE FURNACE. F. A. Halden and R. Sedlacek (Stanford Research Inst., Menlo Park, Calif.). Rev. Sci. Instr., 34: 622-6(June 1963).

The development of an arc-image system for crystal growth, and techniques for obtaining continuous growth of single crystals under controlled atmospheres, are described. Crystals grown include rutile, sapphire, ruby, stabilized zirconia, and ferrites. (auth)

27516 IRON ROOM, MODEL II (Engineering Materials). (Argonne National Lab., Ill.). 12 units. (CAPE-1004)

The Iron Room, Model II, is an iron-shielded facility used with an 8 × 4 in. NaI(TP) crystal as a detector in whole-body radioactivity counting. The walls, floor, and ceiling are built up uniformly to an 8-in. thickness. The outside dimensions of the room are 96 × 84 × 122 in. Inside dimensions are 73.33 × 64.5 × 106 in. From careful measurements made in the room, it was found that 95% of the background count inside the room is indigenous to the room and cosmic rays; therefore any practical amount of additional shielding will not significantly reduce the background. (F.E.S.)

27517 ROTARY MULTICRUCIBLE ARC FURNACE—MARK II (Engineering Materials). (Argonne National Lab., Ill.). 34 drawings. 34 units. (CAPE-954)

A furnace used for melting 6 different alloys at the same time is described. It is a modified version of CAPE-110. The body of the furnace has an OD of 8 in. and an ID of 6.06 in. The walls are double and of type 304 stainless steel. The window of the sight is made of quartz. (F.E.S.)

27518 CELL LINERS (Engineering Materials). (Oak Ridge National Lab., Tenn.). 3 units. (CAPE-942)

Cell liners used for the cell bank and analytical cell in the Multicurie Fission Product Pilot Plant are described. All framing is 2.5 in. × 2.5 in. × 0.25 in. The liners are of type 347 stainless steel and are 11 gage. The analytical cell is 12.5 ft long × 9.02 ft wide; the west side is 13.25 ft × 12.56 ft; the east side is 12.5 ft × 12.54 ft; the south end is 13.25 ft × 12.56 ft; and the north end is 12.5 ft × 9.03 ft. The cell liners in the banks are 6.52 ft in. long, 6.02 ft wide, and 10.5 ft high. (F.E.S.)

27519 TRANSFER MECHANISM FOR HI-LEVEL RADIOCHEMISTRY CELL (Engineering Materials). (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). 10 units. (CAPE-872)

The mechanism described is used to move highly radioactive substances from one cell to another in the High Level Radiochemistry Facility. Sample transfer between cells is accomplished by a double telescoping unit through the common cell wall. The transfer device extends into the cells so that objects can be raised or lowered vertically into or out of the transfer unit. The device is driven by a hand crank located on the operating side of the cell. The 4-in. lead shielding doors on each end of the transfer port may be opened or closed by the manipulators. The doors are gasketed to prevent liquid entry into the transfer mechanism in case of a splash. (F.E.S.)

27520 DECONTAMINATION FACILITY FOR ANP (Engineering Materials). (Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho). 12 units. (CAPE-988)

The decontamination facility consists of a multicure cell room, containing a hot cell with outside dimensions of 15 ft × 21 ft and with 5 ft thick concrete walls, decontamination room, remote analytical facility, rest rooms, change rooms, chemical cleaning room, tool crib, welding shop, metal working shop, and inspection room. The main cell block building is 83 ft × 88 ft. The assembly and maintenance building is constructed of steel and reinforced concrete, is two stories high, and has dimensions of 150 ft × 285 ft. It contains shop areas; decontamination and chemical cleaning rooms; and a high bay assembly area with an overhead bridge type crane. (F.E.S.)

27521 SPECIMEN CUTTING MACHINE, 2A (Engineering Materials). (Du Pont de Nemours (E. I.) & Co. Savannah River Lab., Aiken, S. C.). 13 units. (CAPE-997)

A machine used to cut specimens of radioactive materials for metallographic examination and chemical study is described. This remote control equipment is used in a hot cell. The vise will clamp materials of various sizes from a 0.25 in. cube to a 3.5 × 3.5 × 35 in. bar. An abrasive or a diamond wheel is used which is 12 in. in dia with a thickness of 40 to 125 mils. The materials are cut underwater by the machine which is operated with master-slave manipulators. An air motor 5 in. in dia and 12 in. long drives the cutting wheel. The motor operates by air at 90 psi and delivers 1.9 hp at a cutting wheel speed of 2,000 rpm. (F.E.S.)

27522 IMPROVEMENTS IN OR RELATING TO PIVOT MOUNTINGS FOR REMOTE CONTROLS. Rene Leroy, Antoine Fortin, Jean Vertut, and Marcel Fortin (to Commissariat à l'Énergie Atomique). British Patent 928,052. June 6, 1963. Priority date July 7, 1959, France.

A ball and socket arrangement for controlling and mounting remote handling devices through sealed walls into enclosures is described. A sphere of radiation-absorbent material encased in hard material and enabled by bearing mountings to move in a wall socket contains bearing-supported control-carrying members. This arrangement virtually eliminates friction and permits use of such joints in thick walls. (D.C.W.)

27523 SEALING AND CENTERING DEVICE FOR ROTARY SHAFT. Gaspard Paul Dreyfus, Andre Ertaud, Jean Friberg, Robert Galley, Roger Julia, and Jacques Panossian (to Commissariat a l'Energie Atomique). British Patent 928,440. June 12, 1963. Priority date Feb. 9, 1961, France.

Centering and sealing is provided for a rotating shaft passing through a partition that separates two enclosures with unequal pressures by a fluid bearing located between the shaft and wall assembly and by a molecular rotary pump (with at least one groove) located between the shaft and wall assembly in series with the bearing. (D.C.W.)

27524 IMPROVEMENTS IN OR RELATING TO PUMPS. Stefan George Bauer, Norman Battle, and Martin Honess Kendon (to Rolls-Royce Ltd.). British Patent 928,661. June 12, 1963. Filed Oct. 28, 1960.

A small flow of gas or vapor can be maintained in a circuit by a pumping apparatus that consists of a means for injecting a liquid spray into a duct forming part of the circuit in the direction required for the flow. A volume flow ratio of the gas to the driving liquid of at least 100 : 1 is maintained. The device is particularly useful for cooling shut-down gas-cooled reactors. (D.C.W.)

27525 A MACHINE FOR REMOVING THE CARTRIDGES OF NUCLEAR REACTOR FUEL ELEMENTS. Maurice Alles, Denis Martin, Jose Aymard, and Achille Pellerin (to Commissariat a l'Energie Atomique). British Patent 928,834. June 19, 1963. Priority date May 3, 1960, France.

The machine comprises a supporting structure provided with a jack, cutting wheels, and an assembly of fingers arranged symmetrically around the longitudinal axis of the fuel element. In operation, the fuel element is moved by the jack so that the cutting wheels cut the cartridge of the fuel element, and the fingers are used to separate the cut portions of the cartridge. (D.L.C.)

27526 IMPROVEMENTS IN OR RELATING TO GAS-TIGHT CHAMBERS FOR HANDLING TOXIC SUBSTANCES. Ernest Robert Landon (to United Kingdom Atomic Energy Authority). British Patent 928,849. June 19, 1963. Filed Aug. 18, 1960.

A gas-tight chamber including a posting port, a window, and glove ports in the window, is designed so that it can be rotated about a central vertical axis. The chamber is mounted on a fixed hollow spindle which is provided with a door for communication into the interior of the chamber. (D.L.C.)

27527 MASTER AND SLAVE MANIPULATING ARRANGEMENTS. Donald Jackson (to Pye Ltd.). British Patent 929,352. June 19, 1963. Filed Oct. 29, 1959.

A master-slave manipulator is designed with a viewing device arranged to view the slave portion of the manipulator. The viewing device includes a television camera which is mounted for automatic movement in synchronism with movements of the slave portion, so that the camera always views the slave portion. (D.L.C.)

27528 IMPROVEMENTS IN OR RELATING TO PRESSURE VESSELS FOR VAPOUR GENERATORS. Arthur Charles Lawrence (to Foster Wheeler Ltd.). British Patent 929,681. June 26, 1963. Filed Jan. 30, 1961.

A closure is designed for use in access holes in a pressure vessel for a vapor generator in a nuclear power plant. The closure comprises a diaphragm which is seal-welded to the pressure vessel within an access hole and a plug which is inserted into the access hole to provide backing for the diaphragm. (D.L.C.)

27529 JOINTS BETWEEN TUBES OF DISSIMILAR MATERIALS. Sydney Fawcett, Hale Barnes, and William Rodwell (to United Kingdom Atomic Energy Authority). U. S. Patent 3,093,398. June 11, 1963. Priority date June 24, 1957, Great Britain.

An arrangement for coupling tubes with different thermal expansion characteristics and different diameters by passing the smaller tube through the larger tube is described. Sealing is effected by a metal ring placed between an internal flange on the larger tube and an external flange on the smaller tube. (D.C.W.)

27530 RADIATION RESISTANT MINERAL OILS. Alan Beerbower and John L. Murray (to Esso Research and Engineering Co.). U. S. Patent 3,094,488. June 18, 1963. Filed Nov. 23, 1959.

A method is given for increasing the gamma radiation resistance of mineral oils or lubricating oils. The method comprises adding to the oil a liquid scintillation phosphor and a uv-absorbing compound, in amounts of 75 to 1000 ppm each. Examples of such phosphors are aromatic hydrocarbons, furans, pyrroles, oxazoles, 1,3,4-oxadiazoles, pyridines, indoles, and benzoxazoles. Some examples of the uv-absorbing compounds are substituted benzophenones. (D.L.C.)

27531 RADIOACTIVE BATTERIES. Paul Rappaport (to Radio Corporation of America). U. S. Patent 3,094,634. June 18, 1963. Filed June 30, 1953.

A long-lived radioactive battery using semiconductors is designed which is especially suited for powering transistor circuits. In the battery, a junction or point-contact semiconductor device is irradiated by a radioactive source to liberate charge carriers therein and thereby generate a potential at the output terminals. Several embodiments of the battery are described. (D.L.C.)

Heat Transfer and Fluid Flow

Refer also to abstracts 28084, 28094, 28095, 28097, and 28433.

27532 (AE-106) MEASUREMENTS OF VOID FRACTIONS FOR FLOW OF BOILING HEAVY WATER IN A VERTICAL ROUND DUCT. S. Zia Rouhani and Kurt M. Becker (Aktiebolaget Atomenergi, Studsvik, Sweden). May 1963. 30p.

Void fractions for the flow of boiling heavy water in a vertical round duct with 6.10 mm inner diameter and a heated length of 2500 mm were measured for a wide range of variables. The measurements were performed by a new method, which is based on the (γ,n) reaction, occurring when heavy water is irradiated by gamma rays. The results are presented in diagrams, where the void fractions and the slip ratios are plotted against the steam quality with the pressure as a parameter. The data were correlated by curves, and the scatter of the data around the curves is less than ±5 per cent. (auth)

27533 (AE-107) MEASUREMENTS OF CONVECTIVE HEAT TRANSFER FROM A HORIZONTAL CYLINDER ROTATING IN A POOL OF WATER. Kurt M. Becker (Aktiebolaget Atomenergi, Stockholm). May 1963. 20p.

Measurements of heat transfer from a horizontal cylinder rotating in water are given. The experimental results were correlated by the equation $Nu = 0.11\ Re^{0.68} \cdot Pr^{0.4}$ for a range of rotating Reynolds numbers from 1000 to 46,000, and Prandtl numbers from 2.2 to 6.4. This equation compares very well with the experimental and theoretical information available for air in published works. The analogy suggested by Anderson and Saunders between natural convection from a horizontal plate and the present type of flow was used to predict the Nusselt numbers. Analytical and experimental results were found to compare very well with each other. (auth)

27534 (AERE-M-1203) COMPARATIVE FILM THICKNESS AND HOLDUP MEASUREMENTS IN VERTICAL ANNULAR FLOW. G. F. Hewitt and P. C. Lovegrove (United Kingdom Atomic Energy Authority. Reactor Group. Atomic Energy Research Establishment, Harwell, Berks, England). Apr. 1963. 24p.

Measurements were made of liquid film thickness in the upward annular flow of air–water mixtures in a 1.25-in. bore tube, using three different methods: measurement of the conductance between flush mounted conductance probes (AERE method); measurement of the conductance of the whole liquid film over a length of the tube (method of CISE, Milan); and trapping and measuring the amount of liquid held in the tube between two quick-closing valves (holdup method). In general, the holdup method gives results which are equal to or, at high thicknesses, somewhat greater than the AERE technique, whereas the CISE method gives results almost invariably lower. However, the three methods all give results of the same order and the differences are not sufficient to explain the discrepancy between the AERE results and the CISE film thickness correlation. (auth)

27535 (BNL-801) HIGH-TEMPERATURE LIQUID-METAL TECHNOLOGY REVIEW. A Bimonthly Technical Progress Review. Volume 1, Number 2. O. E. Dwyer, ed. (Brookhaven National Lab., Upton, N. Y.). Apr. 1963. Contract [AT(30-2)-Gen-16]. 45p. (BNL-PR-2)

Metals—technology of high-temperature liquid, review; Systems for Nuclear Auxiliary Power (SNAP-2)—coolant boiling research for; Nuclear Power Plants—development research on thermionic; Los Alamos Molten Plutonium Reactor Experiments—fuel element analysis; Heat Transfer Systems—conference on liquid metal; Bearings—coating for liquid metal, performance of; Systems for Nuclear Auxiliary Power (SNAP-8)—component development; Sodium—heat transfer research on; Mercury—heat transfer research on; Potassium—heat transfer research on; Nitrogen Systems—Hg–N, flow characteristics for two-phase; Mercury Systems—Hg–N, flow characteristics for two-phase; Nuclear Power Plants—heat transfer rejection by space, research on; Alkali Metals—heat transfer research on; Turbines—development of two-stage potassium; Bearings—development of liquid-metal lubricated; Niobium Alloys—properties for alkali metal containment, research on; Rubidium—thermophysical properties of; Los Alamos Molten Plutonium Reactor Experiments—design of LAMPRE-1. (D.C.W.)

27536 (GEAP-3961) PREDICTION OF THE CRITICAL HEAT FLUX IN FORCED CONVECTION FLOW. S. Levy (General Electric Co. Atomic Power Equipment Dept., San Jose, Calif.). June 20, 1962. Contract AT(04-3)-189. 30p.

A superposition model is developed to predict the critical heat flux in forced convection flow. The model is applied to available experimental results in boiling water flows and good agreement is obtained between the model and test data over the multitude of geometries, flow rates, pressures, and fluid enthalpies tested to date. (auth)

27537 (NASA-TN-D-1656) ON THE EMPIRICAL CORRELATION OF CRITICAL BOILING HEAT FLUX FOR CHANNELS OF VARIOUS CROSS SECTIONS AND ORIENTATION. Uwe H. von Glahn (National Aeronautics and Space Administration. Lewis Research Center, Cleveland). June 1963. 21p.

A correlation of boiling heat-transfer data associated with the maximum critical heat flux (burnout condition) in forced flow through uniformly heated circular tubes was extended to include data obtained with water flowing through rectangular channels and annular tubes with channel orientations varying from 0 to 90° upward from the horizontal. Correlation was achieved through the modification of an existing empirical relation by the use of an additional channel-shape factor. (auth)

27538 (NP-12767) PROJECT SQUID SEMI-ANNUAL PROGRESS REPORT, OCTOBER 1, 1962–MARCH 31, 1963. (Virginia. Univ., Charlottesville. School of Engineering and Applied Science). Apr. 1, 1963. Contract Nonr-3623(00). 80p.

Progress being made on the development of jet propulsion through Project SQUID is discussed. Eighteen different programs are discussed and two of these are abstracted in NSA. Information is presented on shock waves, fluid flow, heat transfer, kinetics, transfer processes, combustion, propellant properties, gaseous reactions, and molecular reactions. (N.W.R.)

27539 (NP-12767(p.10-12)) FUNDAMENTAL STUDY OF DYNAMICS OF GASES AND PLASMAS. Guido Sandri, Roger D. Sullivan, Theodore F. Morse, and Edward A. Frieman (Aeronautical Research Associates of Princeton, Inc., Princeton, N. J.).

The theory of single component gases is studied with regard to kinetic and hydrodynamic behavior. Higher order kinetic equations and equipartition equations for homogeneous mixtures are briefly discussed. (N.W.R.)

27540 (NP-12767(p.65-7)) MAGNETOHYDRODYNAMICS OF PARTIALLY IONIZED GASES. James A. Fay, W. C. Moffatt, R. L. Leonard, M. Sajben, and J. B. Workman (Massachusetts Inst. of Tech., Cambridge).

Basic theoretical and experimental studies of the important physical phenomena arising in magnetohydrodynamic propulsion and power generation machines are discussed. The theoretical investigations are centered on a study of the unsteady wave motion in electric and magnetic fields. The experimental portion of the work is focused on the utilization of combustion driven shock tubes to duplicate in the laboratory those conditions of gas velocity, temperature, density, and electric conductivity which might prevail in an actual device. (N.W.R.)

27541 (TID-18909) BASIC STUDIES IN GAS-SOLID SUSPENSION. Quarterly Report No. 63-1, December 1962 through March 1963. (Rutgers Univ., New Brunswick, N. J. Coll. of Engineering). May 1, 1963. Contract AT (30-1)-2930. 18p.

Pressure drop, diffusion, velocity slip, friction factors, and turbulent structure in a flowing gas-solid suspension are investigated. Recent progress in instrumentation development for the experimental loop is discussed. Both experimental and theoretical data are given. (N.W.R.)

27542 (TID-18910) BASIC STUDIES IN GAS-SOLID SUSPENSION. Quarterly Report No. 62-3, August-November 1962. (Rutgers Univ., New Brunswick, N. J. Coll. of Engineering). Jan. 1, 1963. Contract AT(30-1)-2930. 15p.

Gas-solid suspension flow is investigated experimentally and theoretically. The investigation covers fluid mechanics, heat transfer, and flow stability. Operating experience with the loop is discussed. Data are presented for helium diffusion, fanning friction factor as a function of solids loading and Reynolds number, and gas-solid diffusion. (N.W.R)

27543 (NYO-10486) QUARTERLY PROGRESS REPORT [ON TWO-PHASE FLOW AND BOILING HEAT TRANSFER]. G. B. Wallis, D. A. Steen, C. B. Edgar, Jr., and S. N. Brenner (Dartmouth Coll., Hanover, N. H. Thayer School of Engineering). Apr. 1963. Work performed under United States–Euratom Joint Research and Development Program. Contract AT(30-1)-3114. 44p. (EURAEC-674)

Progress made toward obtaining a theoretical understanding of the various flow patterns which occur in two-phase flow is reported. A preliminary study of the stability of annular flow and the formation of droplets which become entrained in the gas core is made. The dependence of droplet entrainment on the flow rates of the components is studied experimentally and a definite critical gas velocity at which entrainment commences is found. Theoretical studies of the formation of very large waves on an annular film and the motion of large viscous bubbles in vertical tubes are presented. The operation of a simple electrical flow regime detector is described. (auth)

27544 (UCRL-10696) LONGITUDINAL DISPERSION IN PACKED EXTRACTION COLUMNS. Alphonse Hennico, Gabriel Jacques, and Theodore Vermeulen (California. Univ., Berkeley. Lawrence Radiation Lab.). Mar. 18, 1963. Contract W-7405-eng-48. 196p.

Axial dispersion in packed beds is investigated with particular reference to extraction-tower design. A new model for dispersion behavior, based upon segmented laminar flow, is derived for analysis of breakthrough curves at low flowrates; its applicability is discussed in comparison with other theoretical models of mixing. Axial dispersion coefficients in single-phase flow were measured by a step-input method over a wide range of Reynolds numbers (3 to 2000). Nine different types of packings were used, involving regular and random arrangements of spheres, and random arrangements of Raschig rings, Berl saddles, and Intalox saddles. Different constant values of axial Peclet number are found in the turbulent range and the laminar range, which are separated by a fairly sharp transition region. Viscosity is found to have a large effect upon axial dispersion; for two solutions of different viscosity, the Peclet-number values are identical at the same Reynolds number. The axial Peclet number is found to vary inversely with bed porosity. No effect of packing arrangement is observed. For two-phase countercurrent flow of water and kerosene, axial-dispersion coefficients were measured for the continuous phase; they were also measured for the dispersed phase, both where the current does and does not wet the packing material. The continuous-phase Peclet number appears to increase with decreasing continuous-phase Reynolds number, and also with an increasing ratio of dispersed-phase flowrate to continuous-phase flowrate. For a nonwetting dispersed phase, the Peclet number remains practically constant, whereas for a wetting discontinuous phase it decreases somewhat with an increasing ratio of discontinuous-phase flowrate to continuous-phase flowrate. On the basis of typical calculations of mass-transfer rates from experimental extraction data, longitudinal dispersion is an important effect and should be calculated as an independent factor in extraction column design. (auth)

27545 LONGITUDINAL DISPERSION IN TWO-PHASE CONTINUOUS-FLOW OPERATIONS. Terukatsu Miyauchi (Tokyo Univ.) and Theodore Vermeulen. Ind. Eng. Chem., Fundamentals, 2: 113-26(May 1963). (UCRL-3911)

In two-phase flow operations, longitudinal dispersion (or axial mixing) has an undesirable effect on equipment performance, especially if a high degree of completion is needed. Mathematical solutions are developed for general and specific cases of longitudinal dispersion accompanying mass transfer or heat transfer, calculated from a simplified diffusion model that assumes a mean longitudinal-dispersion coefficient and a mean velocity for each phase. Concentrations within the equipment and at the outlet are shown to depend upon four dimensionless parameters. These are functions of the dispersion rates and velocities, the equilibrium partition coefficient, and the "true" overall mass-transfer coefficient. Based upon computed tables now available, graphs are included to show how the parameters are related. An empirical correlation is given for "exterior apparent NTU," which serves as a useful design factor. (auth)

27546 THE THERMAL CONDUCTANCE OF URANIUM DIOXIDE/STAINLESS STEEL INTERFACES. A. C. Rapier, T. M. Jones, and J. E. McIntosh (United Kingdom Atomic Energy Authority, Seascale, Cumb., Eng.). Intern. J. Heat Mass Transfer, 6: 397-416(Mar 1963). (TRG-Report-332) (In English)

The thermal conductance of uranium dioxide/stainless steel interfaces was investigated in a disc-type apparatus under vacuum and with different interface gases (helium, argon, neon), and ranges of surface roughness ([11 to 1417] × 10^{-6} cm, arithmetical mean height measured from Talysurf profile records), interface gas pressure (7 to 1226 mm Hg), contact pressure (0 to 570 lb/in^2), mean interface temperature (55 to 410°C), and heat flux (1 to 5.5 cal/s cm^2). To obtain consistent results, the contact faces of the 2-cm

diameter specimens were lapped optically flat and then roughened to a controlled amount. The thermal conductance is the sum of the solid conductance through the small areas of true contact, and the conductance through the gas in the interface (thermal radiation made a negligible contribution). The experimental values obtained for the solid conductance were of the same order as that predicted by the theory of Cetinkale and Fishenden. It was found, as expected, that the solid conductance between uranium dioxide and stainless steel was very low, owing to the hardness of the materials and the poor thermal conductivity of the uranium dioxide. Predicted values of the gas conductance, based on several simple geometrical models of the roughness, and allowing for accommodation effects in collisions between the gas molecules and the surfaces, have been compared with the present experimental results and with other published data. In nearly all cases the measured conductance is within a factor two of the predicted value, which is considered to represent good agreement in view of the very wide range of variables covered by the data and the inaccuracies inherent in this type of measurement. (auth)

27547 TURBULENT HEAT TRANSFER IN A CIRCULAR TUBE WITH VARIABLE CIRCUMFERENTIAL HEAT FLUX. W. C. Reynolds (Stanford Univ., Calif.). Intern. J. Heat Mass Transfer, 6: 445-54(June 1963). (In English)

An analysis for hydrodynamically and thermally fully developed heat transfer in a circular tube with variable circumferential heat flux is presented. The results allow prediction of temperature variations when the tube is heated uniformly in the axial direction and non-uniformly around its perimeter. It was concluded that the effects of circumferential heat flux variation in turbulent flow are sometimes more pronounced than in laminar flow. An example shows the striking importance of these effects. (auth)

27548 HEAT TRANSFER IN ANNULAR PASSAGES. GENERAL FORMULATION OF THE PROBLEM FOR ARBITRARILY PRESCRIBED WALL TEMPERATURES OR HEAT FLUXES. W. C. Reynolds (Stanford Univ., Calif.), R. E. Lundberg, and P. A. McCuen. Intern. J. Heat Mass Transfer, 6: 483-93(June 1963). (In English)

A general formulation was developed for heat transfer in annular passages, and the contributions of several phases of a study program are outlined. Apparatus used in experimental evaluation of annulus heat-transfer functions are described, and an extensive bibliography of annulus literature is included. (P.C.H.)

27549 HEAT TRANSFER IN ANNULAR PASSAGES. HYDRODYNAMICALLY DEVELOPED LAMINAR FLOW WITH ARBITRARILY PRESCRIBED WALL TEMPERATURES OR HEAT FLUXES. R. E. Lundberg (Stanford Research Inst., Menlo Park, Calif.), P. A. McCuen, and W. C. Reynolds. Intern. J. Heat Mass Transfer, 6: 495-529(June 1963). (In English)

A complete analysis for the thermal problem in hydrodynamically fully developed flow is presented. This includes evaluation of the four fundamental solutions in the thermal energy regions by solution of the eigenvalue problem, including development of asymptotic expressions for the higher eigenvalues. The analytical predictions are substantiated by their excellent agreement with careful experimental measurements reported. (auth)

27550 SIMULATION OF POOL BOILING HEAT TRANSFER BY GAS INJECTION AT THE INTERFACE. G. E. Sims, U. Aktuerk, and K. O. Evans-Lutterodt (Imperial Coll. of Science and Tech., London). Intern. J. Heat Mass Transfer, 6: 531-5(June 1963). (In English)

Investigations were carried out on simulated nucleate pool boiling by gas injection at the interface. Heat- and mass transfer coefficients were measured and the results were compared with previous determinations. It was concluded that porous-plate systems appear to simulate nucleate pool boiling at saturation temperature, but drilled plates are not satisfactory as a simulation. (P.C.H.)

27551 INTERNAL HEAT TRANSFER IN FUEL ELEMENTS. J. A. Pearson. Nucl. Energy, 156-64(June 1963).

A review of progress in the field of maximum internal heat transfer in fuel elements is presented. The thermal resistance of surfaces in contact is investigated and the results correlated to theoretical models that enable reasonably accurate results to be estimated over a wide range of conditions. No one model, however, appears to hold for all the conditions that are applicable. The main methods of heat transfer are conduction through peaks or surfaces in contact and conduction through the gas present within these surfaces. It is only at very high temperatures that any account needs to be taken of the heat transferred directly by radiation. (C.E.S.)

27552 FLOW INDUCED DEFLECTIONS OF PARALLEL FLAT PLATES. R. D. Groninger and J. J. Kane (Westinghouse Electric Corp., Pittsburgh). Nucl. Sci. Eng., 16: 218-26(June 1963). (WAPD-T-1485)

Three parallel plate assemblies were tested to investigate the flow-induced deflections of the individual plates. Special strain gages imbedded in the edges of the plates were used to measure plate deflections at flow rates up to 190% of the theoretical collapse velocity. The results indicate that the flow-induced deflection phenomenon is essentially a magnification of built-in channel spacing perturbations. The deflections assume a sine wave shape along the long axis of the channel, with the greatest deflections occurring at the inlet to the channels. Adjacent plates always move in opposite directions at high flow rates, alternately opening and closing coolant channels. Above the critical velocity, deflections were observed which were sufficient to cause adjacent plates to touch. At about 1.9 times the theoretical collapse velocity, a high frequency flutter of the instrumented plates was observed. Use of an inlet support comb eliminated this flutter. (auth)

27553 NUMERICAL SOLUTION OF THE PROBLEM OF VORTEX STREET DEVELOPMENT. Jacob E. Fromm and Francis H. Harlow (Los Alamos Scientific Lab., N. Mex.). Phys. Fluids, 6: 975-82(July 1963). (LADC-5641)

A method is described for the solution of time-dependent problems concerning the flow of viscous incompressible fluids in several space dimensions. The method is numerical, using a high-speed computer for the solution of a finite-difference approximation to the partial differential equations of motion. The application is to a study of the development of a vortex street behind a plate that has impulsively accelerated to constant speed in a channel of finite width; the Reynolds-number range investigated was $15 \leq R \leq 6000$. Particular attention was given to those features for which comparison could be made with experiments, namely, critical Reynolds number for vortex shedding, drag coefficient, Strouhal number, vortex configuration, and channel-wall effects. The nature of the early stages of flow-pattern development was also investigated. (auth)

27554 THE MAGNETO-HYDRODYNAMIC BOUNDARY LAYER IN THE TWO-DIMENSIONAL STEADY FLOW PAST

A SEMI-INFINITE FLAT PLATE. I. UNIFORM CONDITIONS AT INFINITY. T. V. Davies (University Coll. of Wales, Aberystwyth). Proc. Roy. Soc. (London), Ser. A, 273: 496-508(June 11, 1963).

The problem investigated is the flow of a viscous, electrically conducting liquid past a fixed, semi-infinite, unmagnetized but conducting flat plate. The liquid flow U and also the magnetic field H_0 at a distance from the plate are both assumed to be uniform and parallel to the plate. It is assumed that the Reynolds number R and magnetic Reynolds number R_m are large enough for momentum and magnetic boundary layers to have developed. The standard boundary-layer techniques as used in the Blasius solution then apply and the problem reduces to the solution of two simultaneous non-linear ordinary differential equations. These are examined by the use of an iteration method suggested in the non-magnetic problem by Weyl and a solution of reasonable accuracy was obtained for the drag coefficient. This confirms a similar result obtained in a different way by Carrier & Greenspan. The principal result is that the boundary layer thickens and drag coefficient diminishes steadily as the parameter $S = \mu H_0^2/4\pi\rho U^2$ increases. When S attains the finite value of unity the drag coefficient obtained here actually vanishes with the flow reduced to rest by the action of the magnetic field. This result might be inferred qualitatively since a finite amount of work has to be done in conveying liquid particles across the lines of magnetic force. (auth)

27555 THE MAGNETO-HYDRODYNAMIC BOUNDARY LAYER IN THE TWO-DIMENSIONAL STEADY FLOW PAST A SEMI-INFINITE FLAT PLATE. II. THE FALKNER-SKAN PROBLEM. Eleanor M. James (University Coll. of Wales, Aberystwyth). Proc. Roy. Soc. (London), Ser. A, 273: 509-17(June 11, 1963).

The flow of a viscous liquid past a semi-infinite flat plate against an adverse pressure gradient is investigated. The method used is an iterative method suggested in a paper by Weyl. To start the iterative procedure a function is chosen that satisfies some of the boundary conditions and by using this function the first iterative solution was obtained analytically in terms of confluent hypergeometric functions. Two different starting functions were considered. In the first case it was found possible to compare the results obtained with the well-known Hartree numerical solution and even at the first iteration close agreement is achieved. In the second case, the first iterative solution behaves correctly at infinity but the agreement with Hartree's solution is not as good as it is in the first case. (auth)

27556 THE MAGNETO-HYDRODYNAMIC BOUNDARY LAYER IN THE TWO-DIMENSIONAL STEADY FLOW PAST A SEMI-INFINITE FLAT PLATE. III. THE INFLUENCE OF AN ADVERSE MAGNETO-DYNAMIC PRESSURE GRADIENT. T. V. Davies (University Coll. of Wales, Aberystwyth). Proc. Roy. Soc. (London), Ser. A, 273: 518-37(June 11, 1963).

The boundary-layer flow of a viscous electrically conducting liquid is investigated in the neighborhood of a semi-infinite flat plate, the flow being opposed by a magneto-dynamic pressure gradient. The plate is assumed to be unmagnetized and the magnetic field well away from the plate is parallel to the plate. This is the extension of the Falkner & Skan problem to an electrically conducting liquid. The adverse magneto-dynamic pressure gradient being given by Cx^n, an investigation is made of the viscous stress at the plate and also the critical values of the parameters C and n when this viscous stress vanishes. In the nonmagnetic case and in the magnetic case the critical adverse magneto-dynamic pressure gradient is obtained. (auth)

27557 IMPROVEMENTS IN AND RELATING TO STEAM GENERATORS. Alan Bell (to Foster Wheeler Ltd.). British Patent 929,682. June 26, 1963. Filed Jan. 30, 1961.

A steam generator is designed for the generation of steam and superheating of the steam in nuclear power plants. The generator comprises a vertical cylindrical shell, and a vertical bundle of U-tubes within the shell and connected to a pair of headers or to a tube plate. Two steam generating sections are provided on either side of a superheating section which is isolated by trunking. The tube bundle and trunking are surrounded by a baffle open at the bottom for the circulation of the water. (D.L.C.)

27558 IMPROVEMENTS IN OR RELATING TO STEAM GENERATORS. Arthur Charles Lawrence and Lindon Cyril Laming (to Foster Wheeler Ltd.). British Patent 929,896. June 26, 1963. Filed Jan. 30, 1961.

A method is described for the connection of headers to the shell of a tube-and-shell heat exchanger, which gives the necessary strength to withstand the high thermal stresses present, and enables a header to be fixed within a shell from outside the shell. (B.O.G.)

27559 IMPROVEMENTS IN HEAT EXCHANGERS. Arthur Paul Pedrick. British Patent 929,989. June 26, 1963. Filed July 24, 1961.

A heat exchanger is designed in which solid balls are used to effect heat transfer between two fluids. In the heat exchanger, the balls fall under gravity against a stream of the hot fluid, then pass through a valve, fall against a stream of the cool fluid, and then are transported by compressed air to the top of the exchanger. Several embodiments of the heat exchanger and its components are described, one of which is a boiler. (D.L.C.)

Materials Testing

27560 (WAPD-T-1530) PRODUCTION CONFIDENCE IN NDT METHODS. Don M. McCutcheon (Westinghouse Electric Corp. Bettis Atomic Power Lab., Pittsburgh). [Apr. 30, 1963]. Contract AT(11-1)-Gen-14. 30p.

Descriptions are given of nondestructive testing methods that were developed on production components and under production schedule pressures for the fabrication of fuel elements for the Shippingport Pressurized Water Reactor, Core 2. Examples are included that illustrate the changes or additions required to maintain the specified quality and reduce the unnecessary rejections. (B.O.G.)

27561 YOUNG'S MODULUS MEASUREMENTS ABOVE 2000°C. Harry L. Brown and Philip E. Armstrong (Los Alamos Scientific Lab., N. Mex.). Rev. Sci. Instr., 34: 636-9(June 1963).

An apparatus is described for the determination of Young's modulus from thin-rod resonance behavior. The apparatus differs from previously described equipment in that it is capable of operating at temperatures over 2000°C while providing a vacuum or an inert atmosphere around the sample. The transducers operate at ambient temperature and are loosely coupled to the specimen under test by fine tungsten wires. Provision is also made for optical measurement of the thermal expansion of the sample. (auth)

GEOLOGY, MINERALOGY, AND METEOROLOGY

Refer also to abstracts 28128, 28449, and 28450.

27562 (INSJ-54) PARTITION COEFFICIENTS AND RECIPROCAL IONIC RADII. Akimasa Masuda (Tokyo Univ. Inst. for Nuclear Study). Mar. 1963. 17p.

As to the partition coefficient k between the solid and liquid phases in the course of formation of earth's mantle, the following formula was derived: $k = 2\ (1/r - 1/r_0)$ for polyvalent oxyphile element or $k = 1.5\ (1/r - 1/r_0)$ for univalent oxyphile element, where r refers to the ionic radius of an element and r_0 to the effective ionic radius of oxygen which magnitude depends on the valency of the partner cation. Partition coefficients are given for individual elements. (auth)

27563 (NP-12932) SYMPOSIUM ON BACKGROUND RADIATION. ULTRAVIOLET, VISIBLE AND INFRARED LEVELS AND DISTRIBUTIONS. (Chicago. Univ. Labs. for Applied Science). Apr. 1963. Contract SD-71. 121p. (LAS-TR-199-36)

Ten papers on subjects relevant to reconnaissance from high-altitude vehicles are included. Among the topics discussed are investigations of airglow and auroras, radiation reflection by clouds, radiation background presented by the earth, satellite meteorology, and aerial photography. Experiments are described, and data are given. (D.C.W.)

27564 (NYO-10219) A FEASIBILITY STUDY OF RADIOLOGICAL MECHANISMS FOR USE IN GEOPHYSICAL RESEARCH. Annual Report. Charles A. Ziegler, Leonard L. Bird, Paul B. Fredrickson, Richard H. Maehl, and Frederick Williams (Parametrics, Inc., Waltham, Mass.). Oct. 31, 1962. Contract AT(30-1)-2938. 163p.

Work was carried out to determine the feasibility of applying radioisotope measurement techniques to two problems of geophysical significance: the measurement of the liquid-solid ratio in natural waters and, the measurement of the atmospheric argon-nitrogen ratio. The various possible techniques for measuring liquid-solid ratio in natural waters were examined. It was concluded that an attenuation gage using the 22 kev x rays from approximately 1 mc of Cd^{109} provides a determination of the liquid-solid ratio with the required accuracy (10%) at the lower concentration limit of undissolved solids (500 ppm). A geochemical survey of conditions existing at over 100 sampling stations indicated that variations in composition of undissolved and dissolved matter have a small effect on gage accuracy. The use of a simultaneous conductivity measurement to separate the dissolved and undissolved components was also examined. It appears that a two-source attenuation gauge can be used to measure the atmospheric Ar/N_2 ratio to within 10% at balloon altitudes (35 to 40 km). The sources selected were C^{14} (a beta emitter) and Fe^{55} (emitting an EC x ray of 5.9 Kev). The beta source supplies density data essentially independent of gas composition while the iron source responds to changes in the amount of argon present. Theoretical analysis of the performance of both gages together with supporting experimental data is presented. (auth)

27565 (RT/GEO(63)-25) NATURAL TRACING BY SEASONAL VARIATION OF $^{18}O/^{16}O$ RATIO IN A GROUND WATER RESEARCH. V. Cotecchia and E. Tongiorgi (Italy. Comitato Nazionale per l'Energia Nucleare, Rome). Feb. 1963. 13p.

Presented at Symposium on the Application of Radioisotopes in Hydrology, Tokyo, March 5-9, 1963.

In a preliminary research concerning the practical possibilities of natural isotopic tracing of underground waters, Salentine Peninsula was selected to study the underground water present into the cretaceous limestones. In this area sea-water penetrates into the rocky formations of the region influencing its ground water. The isotopic compositions of the sea-water and the water contained in the limestone as well as seasonal variations of the isotopic composition in the rainfalls feeding the ground water are determined. The existence of strata of water seasonally traced is very useful for the interpretation of many hydrogeological phenomena. (auth)

27566 (AEC-tr-5858) DETERMINATION OF ABSOLUTE GEOLOGIC AGE BY THE RHENIUM METHOD. V. M. Aleksandruk. Translated from Byul. Komis. po Orped. Absolyutnogo Vozrasta Geol. Formatsii, Akad. Nauk SSSR, Otd. Geol.-Georgr. Nauk, No. 4, 144-7(1961).

The rhenium method for geologic age determinations is discussed. The existence of radioactive decay of Re and the different geochemical behavior of Re and Os make it possible to determine the absolute geologic age by the new method. Considering the order of the half life of Re, the method can be used for comparatively ancient molybdenites and other Re-enriched minerals. The modern state of the analytical chemistry of Re makes it possible to determine it in molybdenites with sufficient accuracy at a concentration down to 1×10^{-4}%. (P.C.H.)

27567 MEASUREMENT OF NATURAL RADIOACTIVITY IN THE PARIS REGION. J. Servant and O. Tanaevsky (CEA, Paris and Faculté des Sciences, Paris). Ann. Geophys., 17: 405-9(Oct.-Dec. 1961). (In French)

As a result of measurements it was found that radon accumulation above the ground is favored by intense fog, stable air, and temperature inversion due to radiation or to subsidence. It is of the same order of magnitude in a valley as on a table-land. Data are tabulated. (P.C.H.)

27568 METHODS FOR DETERMINATION OF ATMOSPHERIC RADIOACTIVITY. V. B. Vouk and V. Popovic (Inst. for Medical Research and Occupational Medicine, Zagreb). Arhiv Hig. Rada i Toksikol., 13: 245-50(1962).

A review is presented on sources of atmospheric radioactivity, geographic and topographical patterns of distribution, methods of measurement, and maximal permissible concentrations. (OTS)

27569 CORRELATION OF THE RADIOACTIVITY OF SPECIMENS OF AIR. B. M. Saler and V. Popovic (Inst. for Medical Research and Occupational Medicine, Zagreb). Arhiv Hig. Rada i Toksikol., 13: 283-8(1962).

The radioactivity of 13 air specimens collected in Zagreb during 13 consecutive weeks in Feb. to May 1962 was compared with corresponding specimens collected at Sljeme, a 1000-meter mountain near the city. Consistently higher values in the city were considered attributable to its being an industrial center. (OTS)

27570 DETERMINATION OF THE APPARENT AGE OF A NUCLEAR EXPLOSION. B. M. Saler, V. Popovic, and R. Radeka (Inst. for Medical Research and Occupational Medicine, Zagreb). Arhiv Hig. Rada i Toksikol., 13: 307-10(1962).

Calculations were made from data from a nuclear explosion, assuming that all fission products present in each daily specimen originated from one explosion, for each of 62 specimens collected between June 25 and August 25, 1962. It was concluded that the theoretical explosion took place between Feb. 17 and Mar. 21, 1962. (TCO)

27571 PRESENCE OF THORIUM IN THE ROCK SAMPLES OF THE DECCAN TRAPS. S. J. Khambata (St. Xavier's Coll., Bombay). Current Sci. (India), 31: 188-9(May 1962).

Two samples of powdered rock, one from Bandra and one from Worli (Bombay) were examined by spectroscopic carbon electrodes. The region 2000 to 2200 Å was photographed on plates treated with mineral oils. When different techniques of arc and spark excitation were tried, the persistent line 2837.299 of Th was the only line obtained. The line was first obtained with the carbon arc cathode layer method, working with a low intensity arc of 3 amp. Thirty sec after starting the arc, an exposure of about 2 min was given until the powder was completely consumed. The Th line was completely resolved from the Fe line 2837.03. Once the existence of the line was established, in order to obtain it quickly and of sufficient intensity, a d-c arc of 8 amp was used and the slit was opened to 10 μ. From the intensity of the Th line 2837 in the arc, it was concluded that Th is present in minute traces in the rock samples studied, almost at the threshold of the detection limit by the spectroscopic method. (TCO)

27572 ANOMALOUS RADIOACTIVITY OF CLAYS. Yu. I. Serikov (Moscow Inst. of Petrochemical and Gas Industry). Geokhimiya, No. 5, 507-11(May 1963). (In Russian)

Clays of an anomalous radioactivity that are bound to Khadum and Middle-Maikop sediments occur equally with normal clays in sections of oil wells of the Eastern Caucasus Foreland and Crimea. A study of the core material showed that the sediments formed under specific physicochemical conditions favorable to the accumulation of U and organic matter. On diagrams of gamma-ray logs on the whole territory of development of the Khadum clay facies, opposite to clays of an anomalous radioactivity, distinct maxima are observed. Such a geophysical characteristic facilitates a correlation of the Khadum sediments of Crimea and the Caucasus. (auth)

27573 INFRARED RADIATION FROM THE ATMOSPHERE RESULTING FROM HIGH ALTITUDE EXPLOSION X-RAYS. S. D. Drell and M. A. Ruderman. Infrared Phys., 2: 189-203(Sept.-Dec. 1962).

Calculations of infrared radiation resulting from the upper atmosphere being excited by a very high altitude nuclear explosion are presented. The mechanism considered is that of x-ray absorption to form a layer of hot air leading to the formation of NO molecules and the subsequent radiation of the fundamental at 5.4 μ and the 1st overtone at 2.7 μ. (Air Pollution Con. Assoc., Vol. 4, No. 12, May 1963)

27574 ON THE EFFECT OF A WEAK INTERPLANETARY MAGNETIC FIELD ON THE INTERACTION BETWEEN THE SOLAR WIND AND THE GEOMAGNETIC FIELD. John R. Spreiter and Wm. Prichard Jones (Ames Research Center, Moffett Field, Calif.). J. Geophys. Res., 68: 3555-64(June 15, 1963).

Recent developments have indicated the possibility that the presence of a weak interplanetary magnetic field may lead to the formation of a collision-free shock wave upstream from the boundary of the geomagnetic field and to a transition region characterized by an irregular magnetic field in the intervening space. Previous calculations of the coordinates of the shock wave are improved upon by application of recent advances in the theory of gasdynamic shock waves developed for re-entry aerodynamic studies. It is found that the standoff distance of the shock wave is increased significantly over previous estimates and that the new results appear to be at least consistent with observations. Theoretical results are also shown, to illustrate the differences to be anticipated in the transition region when the interplanetary field is aligned parallel or antiparallel to the geomagnetic field in the equatorial plane and when the Alfvén Mach number is greater or less than 2. A number of observational results that display properties similar to those calculated are reviewed to indicate that such phenomena may actually occur in space. (auth)

27575 A CALCULATION OF THE ABUNDANCES OF URANIUM AND THORIUM FROM THE PRIMORDIAL Pb^{206}/Pb^{207} RATIO. Donald D. Clayton (California Inst. of Tech., Pasadena). J. Geophys. Res., 68: 3715-21 (June 15, 1963).

Recent measurements of the neutron-capture cross sections of Pb^{206} and Pb^{207} make possible a calculation of the amount by which the abundances of these two isotopes were enriched by uranium decay at the time of the formation of the solar system. The primordial abundances of uranium and thorium are computed from the cosmochronology of Fowler and Hoyle. It is found that the present abundance ratio in unfractionated material would be U/Pb = 0.0191 ± 0.0017. (auth)

27576 EVIDENCE OF TWO DISTINCT SYNCHRONOUS WORLD IMPETUSES FOR THE MAGNETIC EFFECTS OF THE NUCLEAR HIGH-ALTITUDE DETONATION OF JULY 9, 1962. J. Roquet, R. Schlich, and E. Selzer (Université, Paris). J. Geophys. Res., 68: 3731-2(June 15, 1963).

Data on the magnetic effects of the high-altitude explosion of July, 1962 seem to indicate two distinct synchronous world impetuses. Possible mechanisms for the propagation of the second magnetic effect are discussed. (C.E.S.)

27577 HYDROMAGNETIC EMISSIONS ASSOCIATED WITH THE MAGNETIC STORM OF SEPTEMBER 30, 1961. Lee R. Tepley and R. C. Wentworth (Lockheed Missiles and Space Co., Palo Alto, Calif.). J. Geophys. Res., 68: 3733-7(June 15, 1963).

Frequency-time characteristics of micropulsations from hydromagnetic emissions and noise bursts are presented for the geomagnetic storm of September 30, 1961. Satellite, balloon, and ground observations are given. A number of properties of the hydromagnetic emissions are discussed. (C.E.S.)

27578 HEAT BALANCE OF THE EARTH. L. Bass (Lanchester Coll. of Tech., Coventry, Eng.). Nature, 198: 980(June 8, 1963).

The constraint that the net loss of heat by conduction represents the only sink in the heat balance of the Earth was shown to be considerably weakened by the fact that present experimental knowledge of electromagnetism is entirely compatible with the existence of a rest mass of the photon not exceeding the order of 10^{-47} g. Calculations show that the heat sink provided by the photon mass is also ample to accommodate all the heat involved in present arguments. (C.E.S.)

27579 THE CONTENT OF RADIOACTIVE ELEMENTS IN SEDIMENTARY ROCKS IN OIL- AND GAS-FIELD IN JAPAN AND THE ORIGIN OF RARE GASES IN NATURAL

GAS. Ryûichi Sugisaki (Nagoya Univ., Japan) and Masaki Ohshika. Nippon Kagaku Zasshi, 84: 236-41(Mar. 1963). (In Japanese)

Sedimentary rocks, mostly shales, were collected in southern Kantô gas producing field and Mitsuke oil field, which are considered to be representative of natural gas fields and oil fields in Japan. The contents of radioactive elements, U, Th, and K in the rocks were determined. The contents of U and Th in ppm were respectively 6.8 and 17 in the samples from southern Kantô area and 7.2 and 22 in those from Mitsuke area. The average value for the ratio U/Th was 2.8 in southern Kantô and 3.2 in Mitsuke. From the content of radioactive elements in the rocks, gas-water ratio, and gas composition, it was concluded that He in natural gas of southern Kantô gas producing field is almost of radiogenic origin, while Ar in the natural gas is almost of atmospheric origin. (P.C.H.)

27580 AN AUTOMATIC AEROSOL SAMPLER. K. Spurny and M. Polydorova (Inst. of Physical Chemistry, Prague). Pracovni Lekar., 14: 337-9(Sept. 1962).

A sampler for collection of radionuclides and other atmospheric pollutants is described. (H.H.D.)

27581 RADIOCARBON. Edward S. Deevey, Richard Foster Flint, Irving Rouse, eds. Radiocarbon, 5: 1-349(1963).

Age estimations using the radiocarbon dating system are presented. Data are included from the following sources: UCLA; University of Miami; National Physical Laboratory of England; Geological Survey of Canada; Texas Bio-Nuclear; Isotopes, Inc.; University of Washington; University of Pennsylvania; British Museum; Gakushium University, Japan; New Zealand; University of Goningen, Netherlands; Stockholm; University of Michigan; La Jolla Radiocarbon Laboratory; Tata Institute, India; University of Arizona; Geological Survey of Finland; University of Bern; and Yale. (M.C.G.)

27582 RADIOGENIC STRONTIUM-87 AS AN INDEX OF GEOLOGIC PROCESSES. C. E. Hedge and F. G. Walthall (U. S. Geological Survey, Washington, D. C.). Science, 140: 1214-17(June 14, 1963).

The abundance of radiogenic Sr^{87} relative to Sr^{86} at the time of crystallization has been determined for 45 rocks. The total range in the ratio Sr^{87}/Sr^{86} is less than 2 percent. Ratios for recent lavas range from 0.702 to 0.711. Oceanic basalts are closely grouped at 0.703, whereas ratios for continental volcanic rocks spread from 0.702 to 0.711. Among the volcanic rocks, ranging from basalt to rhyolite, no correlation was found between original ratio and rock type. Older mafic and felsic rocks that include both plutonic and extrusive types also cover this same range in original Sr^{87}/Sr^{86} ratios; however, there is a definite trend with geologic time. Precambrian rocks give values as low as 0.700. The data indicate that Sr^{87}/Sr^{86} of the weathering crust has changed 1.1 percent in 3000 million years, while the ratio in the mantle has changed no more than 0.5 percent. (auth)

27583 PRIMENENIE RADIOAKTIVNYKH IZOTOPOV V INZHENERNYKH IZYSKANIYAKH. (Use of Radioactive Isotopes in Engineering Studies). N. V. Glazov. Moscow, Gosatomizdat, 1962. 68p.

Techniques and equipment for the use of radioactive isotopes in engineering studies are presented. Methods for the study of soil erosion, weathering processes on construction materials, solubility and leaching of ground salts, ground thickness and natural ground moisture, ground layer profiles, and hydrogeological research are presented. (C.E.S.)

27584 RADIOAKTIVNYE IZOTOPY V PRIRODE. (Radioactive Isotopes in Nature). An. N. Nesmeyanov. Moscow, All-Union Publishing House of Science, 1962. 40p.

Radioactive isotopes that occur in nature and their disintegration processes are discussed. The abundance of uranium and thorium isotopes is also considered. Natural radioactive isotopes and their radioactive transformation series are presented. Radioactive isotopes that occur as products of nuclear products in nature are discussed in relation to those radioactive isotopes that occur as products of nuclear explosions. The use of radioactive isotopes in geochronology, archeology, and chemical research is also discussed. (C.E.S.)

HEALTH AND SAFETY

Refer also to abstracts 27053, 28418, 28460, 28487, 28498, and 28573.

27585 (AECL-1765) RADIOSTRONTIUM, RADIOCESIUM AND TOTAL-β ACTIVITIES IN OTTAWA RIVER WATER (JUNE 1960 TO DECEMBER 1962). J. E. Guthrie (Atomic Energy of Canada Ltd. Chalk River Nuclear Labs., Chalk River, Ont.). May 1963. 34p.

The Ottawa River sampling program during the period June 1960 to December 1962 is discussed. Five points for taking composite water samples were established along a 42 mi section of the river in the vicinity of Chalk River Nuclear Laboratories. Composite water samples were also taken from a lake and a well. Strontium-89, Sr-90, Cs-137, and total-β activities were measured. No correlation was found between strontium and total-β activity, or cesium and total-β activity. The results showed the effect of the resumption of nuclear weapons testing on the radiostrontium and radiocesium content of the river water. At no time did the amounts of Sr-89, Sr-90, and Cs-137 approach $^1/_{1000}$th of the 168 hr occupational MPC_w recommended by the International Commission on Radiological Protection for these nuclides. (auth)

27586 (AHSB(RP)R-23) THE CLASSIFICATION OF RADIONUCLIDES FOR TRANSPORT PURPOSES AND THE DERIVATION OF ACTIVITY LIMITS IN RELATION TO PACKAGE REQUIREMENTS. K. J. Aspinall and A. Fairbairn (United Kingdom Atomic Energy Authority. Authority Health and Safety Branch. Radiological Protection Div., Harwell, Berks, England). May 1963. 81p.

Assessments of the likely intake of radioactive material after a transport accident causing serious damage to a package are combined with calculated radiation doses for unit intake of some 280 radionuclides. A theoretical safe limit to the radioactive content of transport packages is thus derived for each nuclide. These data are then used to propose a classification of nuclides by effective toxicity and appropriate package limits suggested for three principal toxicity groups transported in type A packaging: group I, 1 mc; group II, 50 mc; and group III, 2.5 c. A new group of low-toxicity materials is proposed with a package limit of 20 curies for type A packaging. Proposals are made for a number of special forms of radioactive material, such as low specific activity, noble gases, and luminescent compounds. The recommendations are summarized. (auth)

27587 (CLOR-15) RADIOACTIVITY IN SOME FOODSTUFFS, POLAND, 1959-1961. R. Szepke, J. Bilkiewicz, and Z. Malinowski (Poland. Biuro Pelnomocnika Rzadu do Spraw Wykorzystania Energii Jadrowej. Centralne Laboratorium Ochrony Radiologicznej, Warsaw). 1962. 27p.

Measurements were made of gross β activity in samples of milk, cheese, meat, and fish collected in Poland from 1959 through 1961. Data are tabulated. The significance of radioactivity in food in relation to environmental activity is discussed. (C.H.)

27588 (CNI-109) ACCUMULATION OF FISSION PRODUCTS FROM FALL-OUT IN LAKE BIOTA (LAGO MAGGIORE). Final Report, October 1961. A. Berg, M. Merlini, O. Ravera, and V. Tonolli (Italy. Comitato Nazionale per le Ricerche Nucleari. Centro di Studi Nucleari, Ispra and Italy. Istituto Italiano di Idrobiologia, Pallanza). Dec. 1961. 239p.

The total beta radioactivity of water, sediment, plants, plankton, fishes, and molluscs of Lago Maggiore was measured to determine the natural activity plus fallout. Concentration factors for different radioisotopes in various animals were calculated. Extensive laboratory studies were conducted on content of Sr^{89} and Mn^{54} in plants, sediments, molluscs, and fishes of Lago Maggiore. (C.H.)

27589 (CNI-111) CONCENTRAZIONE DI FLUORO NELLE URINE DI INDIVIDUI DELLA COMUNE POPOLAZIONE E DI INDIVIDUI PROFESSIONALMENTE ESPOSTI. TECHNICHE E RISULTATI. (Concentration of Fluorine in the Urine of Individuals from the General Population and in Exposed Individual Workman. Techniques and Results). M. Giubileo and V. Camera (Italy. Comitato Nazionale per l'Energia Nucleare. Centro di Studi Nucleari, Ispra). Dec. 1961. 28p.

The colorimetric method for the determination of fluorine with zirconium–eriochromocyanine R was modified to adapt it to the analyses of any type of material of toxicological importance. $HClO_4$ and $AgClO_4$ is added to urine brought to dryness in the presence of CaO; and then it is distilled until 70 to 100 cc of the liquid is collected. To the distillate (pH 5.0 ± 0.4), hydroxylamine is added and the colorimetric determination is carried out using eriochromocyanine R + $ZrOCl_2$ and is read on the spectrophotometer at 527.5 millimicron. It has been shown that in samples containing between 0 and 1.8552 gammas the absorption is linear. The readings should be done at a constant temperature and after the same length of time once the reagent has been added. The method is applicable to the analyses of water, milk, and other food substances, animal or vegetable tissues, and other substances like filter paper for the analysis of dust. The sensibility of the method is 0.03 gamma/cc and the precision is superior to 97% within the limits of 0.4 to 1.6 gammas/sample. Since the level of fluorine in urine is influenced by its content in water and foods, in order to obtain normal data for Milan, the fluorine content in the urine of 30 healthy people and some foods was measured with the following results: drinking water 45 to 90 gammas/liter (average, 50); milk 310 to 1325 gammas/liter (average, 1205). In 33 workmen slightly exposed to the inhalation of fluorides, the level of fluorine in the urine was 651 ÷ 1640 gammas/liter (average, 1046). (auth)

27590 (EUR-88.f) LES ACTIVITÉS DU GROUPE DE TRAVAIL "DOSIMÉTRIE" D'EURATOM. (The Activities of the Euratom Dosimetry Working Group). P. Delattre (France Commissariat à l'Energie Atomique. Centre d'Études Nucléaires, Saclay) and A. Prosdocimi (European Atomic Energy Community). 1962. 22p.

The EURATOM Dosimetry Working Group was set up in October 1960 with the aim of facilitating and fostering the exchange of information between the countries of the European Community on all aspects of the measurement of nuclear radiation in research reactors. The main functions of the group are the development of methods for measuring nuclear radiation in research reactors, the promotion of standardization of these methods within the countries of the European Community, and to facilitate the distribution of work between the various laboratories concerned in such a way as to avoid useless duplication of effort and to ensure rapid completion of the work. Topics discussed include the integration of thermal neutron flux, the methods applicable

to intermediate energies, and the threshold detectors used for fast neutron flux. Techniques of gamma dose determination are reviewed. (C.H.)

27591 (EUR-223.i) MISURE DI RADIOATTIVITA' AMBIENTALE — ISPRA 1961. (Measurements of Ambient Radioactivity — Ispra 1961). A. Anzani, A. Benco, M. de Bortoli, G. Dominici, P. Gaglione, G. Gandino, and A. Malvicini (European Atomic Energy Community. Nuclear Research Center, Ispra, Italy). 1963. 68p.

The measurements of environmental radioactivity during 1961 at Ispra are described. Data on the concentration of Sr^{90} and Cs^{137} in fallout, lake waters, and food and the concentrations of I^{131} in milk and thyroids of animals are emphasized. (auth)

27592 (HASL-138) FALLOUT PROGRAM QUARTERLY SUMMARY REPORT, MARCH 1, 1963 THROUGH JUNE 1, 1963. Edward P. Hardy, Jr., Joseph Rivera, and William R. Collins, Jr. (New York Operations Office. Health and Safety Lab., AEC). July 1, 1963. 263p.

Data are presented from the HASL Fallout Program, the New Zealand Department of Scientific and Industrial Research, and the Dominion X-Ray and Radium Laboratory in New Zealand. Radionuclide levels in fallout, milk, tap water, diet, and upper air samples are given in tabular form. Interpretive reports and notes dealing with strontium-90 and stable strontium in human diet and bone and the vertical penetration of strontium-90 in soil, are included. A table of approximate fission and total yields of nuclear tests conducted through 1962 is also presented. A bibliography of recent literature pertinent to fallout studies is included. (auth)

27593 (JPL-TR-32-439) FLUX TO DOSE RATE CONVERSION FACTORS FOR GAMMA RAY EXPOSURE. Joseph H. Smith (California Inst. of Tech., Pasadena. Jet Propulsion Lab.). Apr. 27, 1963. Contract NAS-7-100. 8p.

Conversion factors are presented in graphical form for the convenient calculation of gamma field strength in terms of the recommended units of exposure dose: ergs per gram, referenced to carbon. (auth)

27594 (NBS-TN-161) EVALUATION OF UNEXPECTEDLY LARGE RADIATION EXPOSURES BY MEANS OF PHOTOGRAPHIC FILM. William L. McLaughlin (National Bureau of Standards, Washington, D. C.). Aug. 1962. 15p.

Conventional film types used in personnel-monitoring film badges are suitable for measuring x- and γ-radiation exposures only up to 1000 r. By using special processing procedures, it is possible to extend the range of the less-sensitive component of most commercial film packets up to at least 10,000 r. Limitations in precision of readings from changes in rate dependence, energy dependence, and changes in the shape of the characteristic curve in this range are discussed. (auth)

27595 (NP-12902) THE RECOVERY AND RESTORATION OF METROPOLITAN WATER WORKS FOLLOWING NUCLEAR WAR ATTACK. (Engineering-Science, Inc., Arcadia, Calif.). May 1963. Contract OCD-OS-62-106. 155p.

A detailed review was made of existing waterworks preparedness with respect to civil defense in 9 large metropolitan areas. Results indicate that the preparedness of metropolitan water supply systems to recover from the effects of a disaster due to nuclear war is only 50%. Suggestions are presented for improving the preparedness and enhancing the capability for early recovery of water supply utilities in the event of nuclear attack. (C.H.)

27596 (NP-12905) THE PROTON HAZARD IN SPACE — BIOLOGICAL DOSES. Vincent L. Donlan (Aeronautical Systems Div. Physics Lab., Wright Patterson AFB, Ohio). May 1962. 13p.

The flux levels and proton energies of Van Allen belt and solar flare protons are sufficient to present a major biological hazard in space flight. Biological and tissue removal doses are presented and compared for the Van Allen belt and for the solar flare of May 12, 1959. The bulk of the biological dose is shown to be contributed by low energy protons. Shield weights for minimal protection against the proton hazard are computed and found to be on the order of 10,000 pounds per man. (auth)

27597 (NP-12924) RADIATION CONTROL IN THE STATE OF NEW YORK. (New York. Office of Atomic Development, Albany). 1963. 175p.

The comprehensive program of the State of New York for the possession and use of radiation sources is summarized. (C.H.)

27598 (NRL-5882) STUDIES OF THE BUREAU OF YARDS AND DOCKS PROTECTIVE SHELTER. I. WINTER TRIALS. (Naval Research Lab., Washington, D. C.; Bureau of Yards and Docks; Naval Medical Research Inst., Bethesda, Md.; and Army Medical Research and Nutrition Lab., Denver). Dec. 31, 1962. 156p.

A two-day and a two-week winter trial were conducted in a protective shelter (blast, radioactive fallout, and biological and chemical warfare). In each trial 100 volunteers served as the shelter subjects. Since the primary purpose of these trials was to study the engineering features of the shelter, it was considered desirable to conduct the trials with a carefully selected, reasonably homogeneous group of shelterees. Therefore, the shelterees, selected from a group of volunteers, were screened both medically and psychologically. Both trials were conducted successfully, with no major difficulties encountered. Most of the shelter equipment performed satisfactorily; the notable exception was the diesel-generator unit. The ration, basically survival-ration crackers and soup, provided approximately 1800 kilogram calories per man per day. Weight-loss studies indicated that this was a marginal ration. Water was unlimited for drinking purposes but prohibited for personal hygiene; under these conditions, the average total water consumption was 1.8 quarts per man per day. Inlet air temperatures during the trials varied from 12° to 55°F. Although no artificial heating was provided in the shelter, inside temperatures were maintained between 70 and 80°F by adjusting the air-ventilation rate. Hot bunking (50 bunks for 100 men) proved to be an acceptable procedure. Psychological studies indicated that food, lack of water for washing, crowding of the shelter, dirt, and behavior of others were the five leading sources of discomfort. By similar measurements, bunks, lights while sleeping, odors, and temperature and humidity were considered least bothersome. (auth)

27599 (NYO-9773) TRUCKING OF RADIOACTIVE MATERIALS: SAFETY VS. ECONOMY IN HIGHWAY TRANSPORT. Ferdinand F. Leimkuhler (Johns Hopkins Univ., Baltimore). June 1963. Contract AT(30-1)-1477. 164p.

The accident experiences of large motor carriers in the United States are studied in considerable detail in order to devise and estimate suitable measures of the accident risk to truck shipments of highly radioactive materials. Variations in both accident frequency and accident severity are related to the operating characteristics of

tractor-semitrailers on highways, so that a quantitative measure of the relative risk for various shipping strategies can be evaluated and compared with the cost of regulation. The effectiveness of controls for the routing and timing of shipments was found to be highly dependent on the initial shipping condition. There appears to be relatively little advantage, for example, in reducing speeds on superhighways, but considerable advantage in re-routing or delaying shipments over crowded two-lane roads in the winter. Models are developed for balancing the cost of such control measures against estimates of the value of the risk-reduction obtained. In conclusion, it is recommended that a report system be developed for the purpose of detecting those instances of unusually high risk where operational controls would be most effective, and that research be concentrated on the design of containers and vehicles which are capable of withstanding the forces encountered in highway accidents. (auth)

27600 (SC-4905(RR)) THE DESIGN OF A DUST-CONTROLLED VENTED HOOD UTILIZING LAMINAR AIR FLOW. W. J. Whitfield (Sandia Lab., Albuquerque, N. Mex.). June 1963. Contract AT(29-1)-789. 20p.

A laminar air flow vented clean hood is described. This open-front hood provides a clean work area for operations which require removal of particles or noxious gases. This hood provides dust levels of less than 1000 particles per cubic foot 0.32 micron and larger. (auth)

27601 (TO-B-63-6) THE EFFECT OF INTERIOR PARTITIONS ON THE DOSE RATE IN A MULTISTORY WINDOWLESS BUILDING. Albert W. Starbird, Joseph D. Velletri, Robert L. MacNeil, and John F. Batter (Technical Operations Research, Burlington, Mass.). Jan. 31, 1963. Contract OCD-OS-62-14. 60p. (AD-402685)

The effects are evaluated of three common types of interior partitions in multistory structures on the dose rates from infinite uniform fields of fallout contamination. Comparisons are made between experimentally determined steel model results utilizing cobalt-60 gamma radiation and those obtained through use of the OCD engineering manual entitled Design and Review of Structures from Fallout Gamma Radiation. A comparison is made between partition results from limited fields of contamination and previous experimentally determined limited-field results for similar structures without partitions. Agreement is excellent between experimentally measured and computed infinite-field dose rates for the three partition geometries compared: typical box, corridor, and compartment types. (auth)

27602 (EURAEC-416) PRESENT STATUS OF THE STUDY PROGRAM ON THE MOVEMENT OF RADIOELEMENTS IN THE SOIL AT MOL. L. Baetsle, P. Dejonghe, W. Maes, and P. Staner (Société Belge de Chimie Nucléaire, Brussels). 1963. Work Performed under United States–Euratom Joint Research and Development Program. Contract 048-61-4 RDB. 41p. (EUR-140.f). (A translation)

The consequences of an accidental discharge of radioelements into the soil were predicted and an evaluation was made of the reception capacity of the soil for solid materials with a known solubility and elution degree. This program consisted of two essential parts and more specifically of the study of the water movement in the soil and the influence of retention due to the soil materials on the transportation of radioelements by the water. Regarding the study on the water movement it has been stated that micromethods should be elaborated in order to measure the direction and the flowrate on a determined spot instead of using approximating values for a larger region. For this reason injection methods of radiotracers and sampling of the ground water were developed on a micro scale. In one case samples were taken by lowering copper rods or sheets which were activated by chemisorption of the radiotracer. Equipment for direct soil- and ground water sampling was developed. A thorough study was carried out on the retention phenomena of radioelements by sorption on the earth materials. This study lead to the determination and calculation of relative velocities. Finally for the Mol site a first evaluation of the storage capacity has been made for materials with known solubility and containing Cs^{137} and Sr^{90}. Relatively important injections into the soil of Sr^{89} and Cs^{137} were prepared in order to verify the agreement between theory and field observation. (auth)

27603 (JPRS-19866) THE HYGIENIC SIGNIFICANCE OF NATURAL RADIOACTIVITY IN THE MINING AND CONCENTRATING OF CERTAIN RARE METAL ORES AND ITS PART IN THE DEVELOPMENT OF PNEUMOCONIOSIS. B. A. Katsnel'son, K. N. Klyachina, G. V. Belobragina, E. (Ye.) Ya. Girskaya, L. G. Babushkina, I. E. (Ye.) Okonishnikova, G. V. Semenov, and E. P. Panfilova. Translated from Gigiena Truda i Prof. Zabolevaniya, 7: No. 4, 3-9(1963). 13p. (OTS-63-31118)

Results are reported from a survey of hygienic conditions in open-pit mines for Nb and Zr minerals. Both minerals contained an admixture of U and Th oxides. Measurements were made of the dust content of the air, dust dispersion, γ background, Ra and Th concentration in air, and the concentration of short-lived disintegration products in air, and workers were given a medical examination. No changes in the state of health of workers were found that could be attributed to the effect of the increased radioactivity background. Mine dusts were administered endotracheally into the lungs of rats and the animals were examined at periods ranging from 1 to 14 months later. It was concluded that a high quartz content in the dust is a more important factor in the production of pneumoconiosis than the radioactivity levels usually encountered in mine dusts. (C.H.)

27604 CONTAMINATION OF SOME FORMS OF VEGETATION BY LONG-LIVED FISSION PRODUCTS FROM NUCLEAR EXPERIMENTS. H. Hulubei, C. Moruzi, M. Onsescu, and M. Soroiu (Inst. of Atomic Physics, Bucharest and Univ. of Bucharest). Acad. Rep. Populare Romine, Studii Cercetari Fiz., 14: 25-9(1963). (In Rumanian)

The beta activity of 14 samples of grass and 121 samples of moss and lichens, gathered during 1960 in various regions of the country, was measured. By comparing the measurements with a $Sr^{90}-Y^{90}$ standard, the equivalent activity of the samples was expressed in $\mu\mu c$ units of $Sr^{90}-Y^{90}$. Activities of 5 to 15 $\mu\mu c$ $Sr^{90}-Y^{90}$ were found in the grass and 17 to 250 $\mu\mu c$ $Sr^{90}-Y^{90}$ in the moss and lichens. It was established that the moss of rocks and trees was capable of fixing larger proportions of fission products than other plants. The highest activities were found in samples of Grimmia apocarpa. By studying the variation of the beta activity during the course of a year, it was concluded that in addition to the equilibrium of Sr^{90} with Y^{90}, other fission products with much shorter half lives than Sr^{90} are present. (tr-auth)

27605 RECOMMENDED IONIZING RADIATION EXPOSURES FOR EARLY EXPLORATORY SPACE MISSIONS.

S. J. Baum (National Naval Medical Center, Bethesda, Md.). Aerospace Med., 33: 1182-6(Oct. 1962).

Attempts were made to estimate the allowable radiation doses, primarily due to high-energy proton emissions from solar flares, to be experienced by future space pilots. The size of the new permissible exposure dose for early missions will be higher than that presently permitted for radiation workers; nevertheless it must be low enough to prevent acute biological effects that might influence capability to perform tasks. Previous data show that disease symptoms will become apparent at penetrating dose levels of ~125 rad, will increase in severity with increasing exposure, and probably fatality (5% level) will commence at an absorption of ~250 rad. Thus, up to a dose of 125 rad, no overt symptoms will make their appearance that could incapacitate an astronaut. The sole concern is to minimize radiation exposures to levels that will not result in acute disease symptoms, but the increased probability for late effects are accepted as a penalty for success of early missions. It was concluded that space ships must be shielded so that the probability will be large that exposure levels within them will never exceed 100 rad. (TCO)

27606 FOODS AND FALLOUT. Gordon M. Dunning (U. S. Atomic Energy Commission, Washington, D. C.). Borden's Rev. Nutr. Res., 23: 1-15(Jan.-Mar. 1962).

The source and nature of radioactive fallout are discussed, and the effects of the principal constituents: C^{14}, Cs^{137}, Sr^{90}, and I^{131}, on humans are reviewed. Naturally occurring radionuclides in food, such as Ra^{226}, Th^{228}, and K^{40}, are considered from the viewpoint of dietary levels and the doses received by humans. Levels of I^{131} and Sr^{90} following weapons tests are examined with respect to geographic variations and differences in various foods. Hazards of Sr^{90} and possible means of removing it from milk are discussed. It is concluded that there are arguments for accepting the assumption that for every increment of radiation exposure there is a corresponsing increment of biological effect. Based on this and other assumptions, admissible calculations can be made as to the potential number of genetic mutations, and cases of leukemia from radioactive fallout. There is no sharp dividing line below which there is complete safety and above which there is a serious hazard, and the problem becomes one of balancing benefits against risks. (H.H.D.)

27607 IODIDE TO REDUCE RISKS OF REACTOR ACCIDENTS. Brit. Med. J., 1: 628(Mar. 9, 1963).

Possible ways of reducing radioiodine uptake of local populations following a nuclear reactor accident are discussed. The amount of radioiodine released into the atmosphere after the Windscale reactor incident was considerable. Since approximately half of any iodine inhaled or ingested will become localized in the relatively small volume of the thyroid gland, a short exposure to an even moderately radioactive atmosphere can result in an appreciable dose of radiation to the gland. Various substances are known to reduce the uptake of radioactive iodine by the thyroid, such as derivatives of thiourea, used in the treatment of thyroid disorders. Even the safest of them, however, may cause side-effects, and their administration to a random population, including children, would entail risk of harmful effects. Potassium perchlorate and thiocyanate also inhibit the iodine-concerning mechanism of the thyroid, but the use of these drugs would also entail certain risks. Single doses of ~100 mg KI would appear to be reasonably without risk, and although some people are allergic to iodine, iodide is a common component of cough mixtures and other medicaments taken by the population at large. The dose to the thyroid from any radioactive iodine which is subsequently inhaled may be reduced by a factor of about 10 after administration of 100 mg of KI, and this precaution would be useful so long as it is stressed at the same time that the best safety precaution is to leave the dangerous, or potentially dangerous, area till all risk has passed and it has been declared safe by a recognized authority. (H.H.D.)

27608 RADIATION HAZARD IN THE TREATMENT OF SKIN DISEASES WITH THORIUM X. Arthur Wiskemann and Udo Janssen (Universitäts-Hautklinik, Hamburg-Eppendorf, Ger.). Hautarzt, 12: 275-9(Jan. 1961).

Possible hazards, particularly to the dermatologist and his assistants, in the use of local applications of thorium X (Ra^{224}) in salves and ointment for the treatment of skin diseases, such as psoriasis, nevus flammeus, and lichen ruber verrucosus, were assessed. The decay scheme of thorium X through its daughter products (thoron and thorium A, B, C, C′, C′′, and D), the half lives of the products, and their emission characteristics are discussed. Studies in rats showed that topically applied ointment containing thorium X leads to measurable blood levels of radioactivity and deposition of daughter products in various tissues, including gonads. Radioautographs of rat lung and ovary demonstrated α-particle tracks in various tissue constituents. In humans receiving skin treatments with 1000 units thorium X (70 $\mu C/cm^3$) the blood dose reached 2 rem, from which it was estimated that the whole-body dose would be ~3 rem/yr. In the treatment of a number of patients with a total of 30000 units thorium X, it was calculated that the whole-body to the person giving the treatment would be ~15 mr, although at chest level as much as 473 mr would be received. However, this is only $\frac{1}{4}$ to $\frac{1}{7}$ the permissible weekly γ dose. Use of film dosimeters by persons applying treatments showed that the permissible dose was not being exceeded. Measurements of the radiation dose received by the personnel showed that it is mostly from inhalation of air in the treatment room. (TCO)

27609 HOSPITAL DIETARY SERVICE DISASTER PROGRAM. M. Brigid. Hosp. Management, 94: 46-8 (July 1962).

27610 FRESH LOOK AT TRADITIONAL X-RAY PROCEDURE BRINGS LESS RADIATION EXPOSURE FOR PATIENTS, LOWER COST PER X RAY. Harry N. Dorsey (Western Psychiatric Inst. and Clinic, Pittsburgh). Hospitals, 35: 61-4(May 16, 1961).

By use of 14- × 14-in. films instead of the conventional 14- × 17-in. size, routine chest examinations can be made at less cost and with a 20% reduction in exposure to the subject. The shorter film fits the standard 15- × 18-in. cassette without modification. The estimated saving in expense is 17.3%. Nothing of diagnostic value is lost by use of the shorter film since the lower part of the conventional film shows only structures below the diaphragm. (H.H.D.)

27611 PSYCHOLOGIC DISCOMFORTS IN 1962 NAVY PROTECTIVE SHELTER TESTS. John E. Rasmussen (National Naval Medical Center, Bethesda, Md.). J. Am. Dietet. Assoc., 42: 109-16(Feb. 1963).

A study was made of psychologic discomfort factors affecting occupants of a fallout shelter during 2 2-week habitability tests. Twenty-one discomfort indices were ranked by each occupant. The 5 factors ranked first by both groups included lack of water for washing, food, crowding, dirt, and the behavior of others. While nutritionally adequate, the food was a major source of psychologic discomfort. It was concluded that the psychologic or emotional as well as the nutritional, storage, and cost

aspects of food should be considered when stocking shelters. (C.H.)

27612 NUTRITION OF 96 NAVAL RECRUITS DURING A SHELTER HABITABILITY STUDY. Robert Van Reen, David Minard, C. Frank Consolazio, and Leroy O. Matoush (Naval Medical Center, Bethesda, Md. and Fitzsimmons General Hospital, Denver). J. Am. Dietet. Assoc., 42: 117-24(Feb. 1963).

The survival ration utilized for a two-week shelter habitability study proved nutritionally adequate for a group of healthy, young male subjects. The major source of nutrients was a commercial survival ration cracker prepared by the National Biscuit Company. The crackers were supplemented with a variety of jams, condensed soups, peanut butter, sugar, and Pream. Data are presented on the composition of the survival cracker, acceptability of the crackers, daily caloric intake, water balance in the subjects during the two-week shelter trial, and clinical findings on the subjects at the beginning and end of the two-week shelter trial. (C.H.)

27613 RADIOACTIVITY STANDARDS FOR WATER. Ernest C. Tsivoglou and George W. Burke, Jr. (Robert A. Taft Engineering Center, Cincinnati). J. Am. Water Works Assoc., 55: 668-76(June 1963).

No conflict appears among the most recent numerical recommendations of the International Commission on Radiological Protection (ICRP), the National Committee on Radiation Protection of the National Bureau of Standards (NCRP), the Federal Radiation Council (FRC), and the U. S. Public Health Service (USPHS) in regard to standards for the protection of water quality from radioactive contamination. The unanimous recommendation of all of the above advisory groups is that all human radiation exposure should be reduced and minimized to whatever extent this is reasonable and practical. In any particular case, radioactive water quality protection should be based primarily upon a determination of the exposure of those individual persons most likely to ingest the largest quantities of radioactivity. This approach should greatly facilitate and expedite control in specific situations, and should encourage regulatory agencies to assume full responsibility in this area. The principles of pollution control that are outlined may be applied in the control of other kinds of pollutant as well. A period exists in which the greatest concern must be for chronic exposure to trace quantities of a variety of agents, the effects of which will be years in appearing and, even then, difficult to perceive. Hence, the principles and methods developed to control radioactive pollution, which occurs in trace quantities, will prove directly applicable to other pollutants as well, especially the primary principle of minimum exposure. (auth)

27614 DANGER OF CONTAMINATION OF ISOTOPE LABORATORIES. S. Simon and R. Constant (Université, Brussells and Centre d'Étude de l'Énergie Nucléaire, Mol, Belgium). J. Belge Radiol., 46: 306-18(1963). (In French)

Radioactive materials may be used as external emitters, as internal sources, or as tracers. According to their use in medical services or in biological research laboratories, the risks are different. In medical services, radioactive materials may be used in the form of either sealed or nonsealed sources. The sealed sources in general present but a risk of external irradiation. The sealed sources in general contain β or β-γ emitters with generally no risk of long-lasting residual radioactivity in organisms. The risks at manipulation level are equal to the radiotoxicity of mean or short-lived β and γ emitters. In the biological research laboratories, the risk may arise from the accumulation of many different substances. The need is stressed for constant surveillance to avoid contamination of laboratories. (C.H.)

27615 THE MEDICAL CONTROL OF IONIZING RADIATION IN MASSACHUSETTS INDUSTRY. Harold Bavley, Heinrich G. Brugsch, and Robert L. Devlin (Massachusetts Dept. of Labor and Industries, Boston). J. Occupational Med., 4: 311-13(June 1962).

The general labor laws as administered by the Massachusetts Department of Labor and Industries were supplemented on Dec. 1, 1957, by an all-inclusive flexible code known as Industrial Bulletin No. 5 (Rules and Regulations for the Protection of the Health and Safety of Employees from Occupational Diseases caused by Ionizing Radiation). The code includes a medical control program and recommendations represent minimum requirements that must be expanded wherever regular heavy exposure close to the maximum permissible dose occurs, or wherever specific substances are involved that may require additional tests or examinations. A medical examination should be given to any person prior to his assignment involving an expected exposure to ionizing radiation that will result in a dose in any calendar quarter in excess of 25% of the maximum permissible dose, or who will be exposed to airborne radioactive material in an average concentration in excess of 10% of the limits specified. The time lost from work in industries using ionizing radiation since the inception of this code amounts to less than one work week. It appears certain that properly executed medical control programs have played an important part in keeping the frequency and severity rates much lower than the average accident rate for all industries in Massachusetts. (TCO)

27616 REACTION TO TOXIC BERYLLIUM COMPOUNDS: TERMINOLOGY. Harriet L. Hardy (Massachusetts Inst. of Tech., Cambridge). J. Occupational Med., 4: 532-4(Oct. 1962).

The history of the recognition of a specific disease among Be workers is briefly reviewed, and the choice of a name for the disease entity is discussed. The evidence is sound that Be disease is a systemic intoxication. The disease is an intoxication that may involve one or more organs and upset normal metabolism as a result of exposure to toxic Be compounds at disease-producing levels. While the inhaled Be may be a fine dust or a fume in its physical form, it appears clear that the resulting illness is not a pneumoconiosis. Besides pneumoconiosis, other unsatisfactory designations have been used. The most workable designations are Be disease and Be poisoning (acute or chronic). Too narrow (pathologic designation) is the phrase pulmonary granulomatosis of Be workers. Beryllosis, berylosis, and beryllosis are confusing, and the latter 2 are incorrect in the derivation of their spelling (from beryl, not Be). The term berylliosis, although accurate, is not used because there is confusion in its spelling and definition. (TCO)

27617 CASE STUDY NO. 1: URANIUM MILLING AND MINING. W. Clark Cooper (Public Health Service, Washington, D. C.). J. Occupational Med., 4: 614-27(Oct. 1962)

After a consideration of the high incidence of lung cancer in the Schneeberg and Joachimsthal mines in Saxony and Bohemia over several centuries, on account of high concentrations of Rn in the mines, experience in the American U mining industry is recounted. Environmental reconnaissance of American mines in 1949-50 showed that Rn concentrations in unventilated mines were comparable to those recorded in Schneeberg and Joachimsthal. Concentrations of Rn as high as 10000 mμC/l of air were found and in many

cases were above 3000 and 4000. A health survey was conducted in the Colorado Plateau between 1950 and 1960 on U miners in attempts to detect increased incidence of lung cancer. Figures were also obtained on over 6000 determinations of Rn and Rn-daughter products from 678 different mines over a 10-yr period. There has been some improvement since 1952, when 55% of the mines employing 64% of the miners had atmospheric concentrations of 1000 mμC of Rn-daughter products per l of air, or more. In 1957, 1958, and 1959, however, ~ half of the samples each year exceeded the recommended working level and ~20% each year exceeded 10 times the recommended working level. The study group of 3306 miners had worked in 400 mines, and an analysis made in 1959 showed a total exposure of some 12,000 man-years. By the end of 1959, 108 deaths had occurred among the miners. The observed and expected numbers of deaths grouped by major causes for the total white U miner group were found to be significantly different for only 4 cause-of-death categories. (TCO)

27618 ACCIDENTS IN HANDLING RADIOACTIVE MATERIALS. H.-J. Marcinowski (Isotope-Studiengesellschaft e. V., Frankfurt am Main). Kerntechnik, 5: 201-4 (May 1963). (In German)

From a collection of accidents in handling radioactive materials, which is being compiled, a preliminary evaluation of 265 accidents in the USA is presented. It was concluded that the material reviewed until now does not corroborate, either by frequency or by extent, the ideas on the dangers connected with the handling of radioactive materials so that a relaxing of certain regulations in the handling of these materials seems justified. (auth)

27619 TESTS ON LUMINOUS COMPOUNDS ACTIVATED WITH PROMETHIUM 147. W. Veit (Firma Buchler & Co., Brunswick). Kerntechnik, 5: 221-4(May 1963). (In German)

Luminous compounds activated with Pm^{147} are commercially available. The reasons why Pm^{147} was given preference are outlined. The activity, the natural decrease in luminosity, the luminous capacity in powder form and applied to surfaces (coated objects), and the dependence on the crystal size of the phosphor are described. Radiation intensity and absence of radioactive contamination in such colors play an important part when daily employed; therefore the characteristics were determined and checked by measurements. The danger of radiation from use of Pm^{147}-activated luminous paint was estimated. (auth)

27620 EVALUATION OF DATA OBTAINED BY MEDICAL CONTROL IN PERSONNEL EXPOSED TO IONIZING RADIATIONS. Branko Prpic, Marko Saric, and Magda Harmut (Inst. for Medical Research and Occupational Medicine, Yugoslav Academy of Arts and Sciences, Zagreb). Lijecnicki Vjesnik, 85: 179-82(1963).

Data on hemogram studies on 31 men and 19 women professionally exposed to x radiation during the course of 2 years are presented. (OTS)

27621 FOOD FOR SURVIVAL IS THE DIETITIAN'S CONCERN. Jane Hartman. Mod. Hosp., 98: 142-3(Apr. 1962).

Survival rations to be used in event of a thermonuclear attack are discussed. (H.H.D.)

27622 ALPHA-PARTICLE ACTIVITY AND FREE RADICALS FROM TOBACCO. Ernest Marsden and Michael A. Collins (Dominion Physical Lab., Lower Hutt, N. Z.). Nature, 198: 962-4(June 8, 1963).

Results are reported from measurements of α activity in leaf tobacco used for cigarettes, in cigarettes on the market in the United Kingdom, and in specially-made standard size unblended cigarettes made from tobaccos originating from widely-separated geographical locations. The origin of free radicals in tobacco smoke is discussed. The contributions of α radiation and free radicals in cigarette smoke in the induction of lung cancer are discussed. (C.H.)

27623 MEDICAL CARE IN DISASTERS. II. HOSPITAL ORGANIZATION. J. Th. H. Grond and J. W. K. Neuberger. Ned. Tijdschr. Geneesk., 106: 1984-8(Oct. 6, 1962).

Plans for hospital preparedness for castastrophes, including thermonuclear war, are discussed, and means for monitoring and protecting against radioactivity are outlined. (H.H.D.)

27624 THE DEVELOPMENT OF PROTECTIVE EQUIPMENT FOR NUCLEAR DECONTAMINATION SYSTEMS. A. C. Thorne. Nucl. Energy, 145-56(June 1963).

A review of various types of protective equipment used in connection with radioactive decontamination systems is presented. A description of decontamination areas, decontamination methods, laundry techniques, active waste handling, protective suits, air hose systems, control room systems, clean air supplies, routine maintenance and emergency systems, mobile units, disposable suit techniques, respirators and air line masks, and high velocity cooling systems is given. (C.E.S.)

27625 NEW ICRU RECOMMENDATIONS ON RADIATION QUANTITIES AND UNITS. Harold H. Rossi (Columbia Univ., New York). Nucleonics, 21: No. 7, 75-8(July 1963).

Sources of confusion in the terminology of radiological physics and radiation protection are discussed, and recent recommendations by the International Commission on Radiological Units and Measurements are presented and explained. (D.C.W.)

27626 PRESENT STATUS OF MEDICAL RADIOLOGY AND PROTECTION AGAINST IONIZING RADIATIONS. Wladyslaw Deptuch. Polski Tygod. Lekar., 17: 448-51 (Mar. 19, 1962).

27627 THE PROBLEM OF RADIATION PROTECTION IN AGRICULTURE AND AGRICULTURAL RESEARCH. Jaromir Chysky (Inst. for Hygiene, Prague). Pracovni Lekar., 14: 130-3(Apr. 1962).

Safety measures to be used in the storage and handling of radioisotopes employed in agricultural research are outlined. (H.H.D.)

27628 DETERMINATION OF LEAD-212 IN THE ATMOSPHERE OF MEXICO CITY AS A MEASURE OF ITS CONTAMINATION. A. Moreno Moreno and A. Rodriguez Fraga (Universidad Nacional, Mexico [City]). Rev. Mes. Fis., 11: 243-54(1962). (In Spanish)

Included are measurements of the concentration of Pb^{212} in the atmosphere of the Federal District of Mexico, as well as the correlation between natural radioactivity and precipitation in the period between May 1961 and January 1962. This method provides an easy procedure for determining the contamination of the atmosphere. (auth)

27629 RADIOGEOLOGY AND POPULATION EXPOSURE TO BACKGROUND RADIATION IN NORTHERN NEW ENGLAND. Ascher Segall (Harvard Univ., Boston). Science, 140: 1337-9(June 21, 1963).

Results are summarized from a variety of surveys of natural radioactivity in northern New England. These include a radiogeological survey of bedrock radioactivity in Maine, New Hampshire, and Vermont; a personnel-monitoring survey of population exposure to external γ radiation in selected areas of high and low bedrock radio-

activity; and a survey of the concentration of Ra^{226}, Ra^{224}, and Po^{210} in teeth extracted from life- or long-time residents of these same areas. The possibility that chronic exposure to low doses of ionizing radiation is of etiologic significance in the genesis of certain human diseases is discussed. Difficulties inherent in measurements of population exposure from natural radioactivity are evaluated. Results of the survey showed no significant relationship between equivalent uranium concentration and the level of Ra^{226} and Po^{210} in teeth. While the geological data suggested considerable intercategory variation in terrestrial sources of radioactivity, dosimetric evaluation of population exposure revealed relatively small differences with respect to external γ radiation. (C.H.)

27630 PUBLIC HEALTH RESPONSIBILITIES IN RADIATION PROTECTION. Fourth Report of the Expert Committee on Radiation. World Health Organ., Tech. Rept. Ser., No. 254, 1-23(1963).

The nature and scope of public health responsibilities in radiation protection, basic elements of a legal system for exercising radiation control, and organization of services required to meet public health responsibilities for radiation protection are discussed. Three recommendations are given for radiation protection by health agencies. (P.C.H.)

27631 GENERAL CONCEPTS AND PRESENT STATUS OF RADIATION PROTECTION IN THE WORLD WITH PARTICULAR REFERENCE TO GREAT BRITAIN. Emilia Nierenska. Zdrowie Publiczne, 76: 433-48(Nov.-Dec. 1961).

A review. (H.H.D.)

27632 MEDICAL ASPECTS OF RADIATION ACCIDENTS. A HANDBOOK FOR PHYSICIANS, HEALTH PHYSICISTS AND INDUSTRIAL HYGIENISTS. Eugene L. Saenger, ed. (Cincinnati. Univ. Coll. of Medicine). Feb. 1963. 372p. $1.75(GPO).

Topics discussed include: procedures to be followed the first 12 hr after an accident; later emergency period; clinical features of the acute radiation syndrome; therapy and long-term follow-up studies; hospital disaster plans for radiation accidents; problems of psychological upset; accidents involving primarily external sources of radiation; accidents involving exposure to radionuclides; reactor and critical assembly accidents; nuclear chain reacting systems; role of civilian authorities and public relations; governmental aid and legal requirements; fires from nuclear materials; nonmilitary nuclear weapon accidents; relation of radiation accidents to mass disaster and large-scale emergency programs; and procedures for purification of water and food. Several useful tables are included also. (P.C.H.)

27633 ISODOSE CHARTS AND DEPTH DOSE TABLES FOR MEDIUM ENERGY X RAYS. K. C. Tsien and M. Cohen. London, Butterworths, 1962. 312p. $29.50.

Two hundred fifty isodose charts for x rays of half value thickness (HVT) 1.0, 1.5, 2.0, 2.5, 3.0 mm Cu, at 50 cm focus-surface distance are presented. There are 50 charts for each HVT including 9 circular, 9 square, and 16 rectangular fields. A brief account of the work that led to the publication and of the problems involved is included. The origins of the basic experimental data and the method of calculation are described, and the application of the charts to other physical and geometrical conditions is discussed. (C.E.S.)

INDUSTRIAL APPLICATIONS OF ISOTOPES AND RADIATIONS

Refer also to abstracts 27092, 27504, and 27505.

27634 (NCSC-2477-4) APPLICATIONS OF NUCLEAR RADIATION AND RADIOISOTOPES TO TEXTILE MATERIALS AND PROCESSES. Progress Report, December 1, 1960 to August 31, 1961. Quarterly Report, June 1, 1961 to August 31, 1961. Arthur A. Armstrong, Jr. and Henry A. Rutherford (North Carolina State Coll., Raleigh. School of Textiles). Sept. 1, 1961. Contract AT(40-1)-2477. 46p.

The rate of graft polymerization of acrylonitrile to cotton by the vapor-phase technique was increased by an increase in the flow rate of the carrier gas (nitrogen). The rate of grafting was also increased by both partial acetylation and cyanoethylation of the cotton but was unaffected by partial methylation and carboxymethylation. In the instance of acetylation the rate of grafting is directly proportional to the degree of substitution. The effect of oxygen on the graft polymerization of acrylonitrile to cotton, cyanoethylated cotton, acetate, and triacetate was investigated. The data indicated that graft polymerization of acrylonitrile to cotton, which was small in any case, was affected very little by trace quantities of oxygen. Oxygen decreased the amount of grafting tremendously with cyanoethylated cotton as well as with the acetates, which showed the largest effect. Gamma radiation of cotton inhibited microorganism attack for a short period of time and retarded the rate of spore growth. The graft polymerization of acrylonitrile to cotton cloth produced a material resistant to attack by penicillium oxalicum and to heat degradation. Acrylonitrile addition of 4% or more prevented completely the spore growth of penicillium oxalicum for 28 days at 28 ± 2°C and 95% relative humidity and the breaking strength of the cloth was unaffected by the microorganism. The loss in breaking strength of cotton cloth grafted with acrylonitrile and heated for 16 hours at 160°C decreased linearly with acrylonitrile content from 40% for untreated cotton to 27% for 12% acrylonitrile content. Post-irradiation grafting of acrylonitrile to cotton was also investigated. Cotton yarn skeins were irradiated in a nitrogen atmosphere and then placed in either boiling acrylonitrile or the acrylonitrile vapors. There was no addition of acrylonitrile to the cotton under the latter conditions. There was some homopolymer formed in the boiling acrylonitrile and some surface polymer and grafted polymer on the cotton yarn. Further investigations were initiated in an attempt to explain the poor results obtained by the post-irradiation experiment. Acrylonitrile was grated by the vapor phase technique to cotton, cyanoethylated cotton, acetate, and triacetate. It was found that water was necessary for the graft polymerization of acrylonitrile to cotton but not to the derivatives. Oxygen had little effect on the addition of acrylonitrile to cotton and decreased the rate of addition to cyanoethylated cotton and the acetates. Irradiation of filament yarns of rayon, acetate, polyamide, acrylic, polyester, and polypropylene in a nitrogen atmosphere in a Co^{60} source (3.8×10^5 roentgens per hour) did not change significantly the physical properties (breaking strength, elongation, and modulus) over the range of absorbed dose of 1×10^3 rad to 5×10^5 rads. It was demonstrated that copper, manganese, and gold could be added to cotton yarn as tracers for activation analysis. Gamma spectra were obtained on the various textile fibers for the long and medium half-life isotopes. For some of the fibers, spectra of the short half-life isotopes were also obtained. (P.C.H.)

27635 (NP-12928) ISOTOPES, RAYONNEMENTS, AGRICULTURE. BULLETIN BIBLIOGRAPHIQUE NO. 4. (Isotopes, Radiations, Agriculture. Bibliography No. 4). (France. Commissariat a l'Energie Atomique. Centre d'Etudes Nucleaires, Saclay). Apr. 4, 1963. 36p.

References are presented on applications of radiation and radioisotopes in agriculture. (C.H.)

27636 (NP-12929) ISOTOPES, RAYONNEMENTS, AGRICULTURE. ETUDE BIBLIOGRAPHIQUE NO. 1. INDUCTION DE MUTATIONS CHEZ LES PLANTES SUPÉRIEURES D'INTÉRÊT AGRICOLE PAR LES RAYONNEMENTS BÊTA, GAMMA, LES NEUTRONS ET LES PROTONS, 1955–1960. (Isotopes, Radiation, Agriculture. Bibliography No. 1. Induction of Mutations Among Higher Plants of Agricultural Interest by the Radiations Beta, Gamma, Neutrons and Protons, 1955–1960). (France. Commissariat a l'Energie Atomique. Centre d'Etudes Nucleaires, Saclay). 1962. 291p.

References are presented on applications of radiation and radioisotopes in agriculture. (C.H.)

27637 (SAN-1020) APPLICATION OF RADIOCHEMISTRY IN FOOD PROCESSING RESEARCH. PART I. RADIOISOTOPIC TRACER TECHNIQUES FOR DETECTION AND MEASUREMENT OF DETERGENT RESIDUES ON WASHED FOODS. Annual Report. Walter A. Mercer (National Canners Assn. Western Research Lab., Berkeley, Calif.). Apr. 6, 1962. Contract AT(04-3)-296. 90p.

In view of the wide spread use of detergents and wetting agents in the food industries and the great need to employ these washing aids in more effective removal of microbial, chemical, and, possibly, radioactive contaminants, an extensive series of food washing studies was undertaken. The studies were intended to determine to what extent commercial food washing procedures remove residual detergent and to define the washing and rinsing conditions required for thorough cleaning of fruit and vegetable products. Radioactive surfactants and tracer techniques were used. The investigation gave particular attention to the washing of green and white asparagus selected because it is industry practice to detergent wash this vegetable. The effect of changes in washing and rinsing conditions was measured in terms of removal of bacterial contaminants, and deposition and removal of radioactive detergent residue. The accumulated experimental data indicate the following: (1) Type of detergent most effective in removal of bacterial spores and the effect of detergent type, anionic or nonionic, on the concentration of bound detergent residue. (2) Most effective combination of contact time, temperature, and pressure of application of the detergent solution for removal of bacterial spores from the test foods. (3) Most effective rinsing conditions, including volume, pressure of sprays, and temperature of rinse water, for adequate removal of bacterial spores and detergent residue. (4) Washing and rinsing conditions which affect the concentration of bound detergent residue in or on the washed foods. A second phase of the contract work was concerned with the use of detergents in washing olives, previous to brine storage. The

anti-shrivel effect and improved fermentation of the detergent wash were advantages in addition to the more effective removal of contaminants. Use of radioactive detergent in experimental washing studies showed that all significant amounts of detergent residue were removed by subsequent processing of the olives. However, where radioactive detergent was added directly to the storage brines high concentrations of bound residue were found in the olives after final processing. A series of experiments was performed to study the effect of wetting agents when added to the caustic solutions used to peel apricots, peaches, and tomatoes. Experimental results and observations indicated use of wetting agents in peeling solutions made possible the following: (1) more uniform peeling; (2) higher product yield; (3) use of lower caustic concentration, and (4) reduction of rinse water volume required for removal of excess caustic from the peeled product. Particular attention was given to the extent of infiltration and removal of the wetting agent during the peeling and rinsing operations. The experimental results showed that some diffusion of wetting agent into peripheral tissues of the peeled fruit and tomatoes took place. However, adequate rinsing of the peeled products removed all but a trace concentration of the radioactive residue. Under the conditions of these experiments, the average concentration of residue was less than 0.05 ppm in peeled and washed peaches and tomatoes. This is considered not to be significant from the standpoint of food adulteration. (D.L.C.)

27638 (SAN-1021) APPLICATION OF RADIOCHEMISTRY TECHNIQUES IN FOOD PROCESSING RESEARCH. PART II. RADIOISOTOPIC TRACER TECHNIQUES IN EVALUATION AND IMPROVEMENT OF INDUSTRY PRACTICES FOR REMOVAL OF PESTICIDE RESIDUES FROM FOODS. Progress Report. Walter A. Mercer (National Canners Assn. Western Research Lab., Berkeley, Calif.). May 1962. Contract AT(04-3)-296. 61p.

Problems met in determining the extent to which commercial processing practices remove pesticide residues from foods are discussed, and the use of tracer techniques for evaluating the effectiveness of various practices is described. Results of some tests on the effectiveness of processing procedures are given, and the methods used in the evaluations are described. Neutron activation analysis is noted to be an extremely promising tool for these investigations since no radioactive pesticides have to be applied to the foods. (D.C.W.)

27639 (TID-18881) ON THE DEVELOPMENT OF KRYPTON AS A UNIVERSAL TRACER. Quarterly Report, February 1 to April 30, 1963. (Parametrics, Inc., Waltham, Mass.). Contract AT(30-1)-2757. 20p.

Krypton was used to determine concentrations of H_2O in methanol as low as 0.015% (156 ppm) and the total mass of H_2O was as little as 0.031 mg (31 μg). Studies of the parametric dependencies of the process of kryptonation by diffusion were extended in the range of pressure to the vicinity of 50,000 psi. Spectroscopically pure C rods and Cu foils were studied, and both were found to display collection behavior substantially different from one another and from that observed at lower pressures. Preliminary investigations were also made on the wear and tear of kryptonated Cu and Ni. (P.C.H.)

27640 (USNRDL-TR-638) USE OF La^{140} AS RADIOTRACER IN (PRE-BUGGY) CHEMICAL EXPLOSIONS. PREPARATION AND DETERMINATION OF ITS REACTION WITH ENVIRONMENTAL MATERIALS. W. B. Lane, M. J. Nuckolls, and R. M. Railey (Naval Radiological Defense Lab., San Francisco). Apr. 4, 1963. 24p.

The pre-Buggy experiment was designed to measure the fraction of vented radioactivity from a series of HE underground detonations containing radioactive sources. Capsules containing curie amounts of La^{140} were sufficient to provide a radiotracing of the debris which resulted from the detonation. Particle size measurements of the debris indicated that La^{140} was adsorbed on the surface of the soil particles. Some 96% of the activity was associated with sub-sieve particles representing only 8% of the mass and 90% of the available surface area. (auth)

27641 THE USE OF RADIOISOTOPES AND RADIATIONS. M. F. Van der Linden. Belgicatom, 8: No. 42, 11-14(Feb. 1963). (In French)

Three typical industrial applications of radioisotopes are described. The enamel thickness in sanitary equipments was determined by introduction of Na^{24} in aqueous solution into the enamel and measuring the emitted β and γ radiation of 1.30 Mev and 1.37 Mev, respectively, with an end-window Geiger counter. A 0.2-mm thick layer could be determined in 5 sec with a precision of 10% provided the radioactive additive is at least at a 150 μc/l level. A warning system, actuated by a 100 μC source of Sr^{90}, and using a collimator and Geiger counter with amplifier and integrator is described for the prevention of turbine stoppages of ships by detecting displacements of the turbine rotor axis. The filling level of a blast-furnace was controlled by placing 760-mC Co^{60} γ sources at 3 different places in the furnace mouth and adjusting 5 Geiger tubes opposite the sources in such a way that 5 different levels could be indicated. Five lights on the furnace operator's control board were actuated by a relay system of the Geiger counters giving at every instant the filling level corresponding to the location of sources and detectors. (OID)

27642 DETERMINATION OF CALCIUM CARBONATE MOISTURE CONTENT BY A RADIOISOTOPE TECHNIQUE. Mei-chen Schneiter, Wayne V. Kessler, and John E. Christian (Purdue Univ., West Lafayette, Ind.). J. Pharm. Sci., 51: 1005-6(Oct. 1962).

Transmission of β particles through $CaCO_3$ samples with different moisture contents was studied. It was found that the transmission was linearly related to the moisture content. The radioactive source was a $^3/_{16}$-in.-dia deposit of $Sr-Y^{90}$ in the center of a $1^1/_2$-in. Al planchet having 5 concentric circular grooves on the bottom. The activity of the deposit was 218,000 cpm at a distance of 2.4 cm from the detector window. The $CaCO_3$ sample layer must be as uniformly dense as possible in order to get reproducible results, so slugs having convex surfaces were made from the stock samples with a 1-in.-dia punch and die set and a laboratory press. Each slug was placed in a geometrically reproducible position over the $Sr-Y^{90}$ source under a Geiger-Müller tube in the Pb shield. The distance from the top of the slug to the thin window of the tube was 1.8 cm. The β-particle transmission was determined during 2 min. An inverse linear relation between cpm readings and moisture content was found over the range 1.04 to 8.65% water (5913 to 4568 cpm). The standard deviations for each moisture content range from $\pm$0.80 to $\pm$2.21%. However, the expected counting error for the 2-min counts is about 1%. The counting error could be reduced by either taking longer counts or using a more intense β source. (TCO)

27643 DETECTION OF SUBMICROSCOPIC AEROSOLS BY MEANS OF CONTINUAL RECOIL LABELING WITH RADON DECAY PRODUCTS. Čestmir Jech (Tschechoslowakischen Akademie der Wissenschaften, Prague). Staub, 23: 55-7(Feb. 1963). (In German)

A method is described enabling the activation of aerosols by the fission products of radon to such an extent that a continuous measuring of the concentration of aerosols by defining the radioactivity can be performed. For such activation radon is used, embedded in the wall of a pipe, from which the Po^{218} atoms dissipate by repulsion into the gas-stream, lead through the pipe, and thus adhere to the aerosols. Two devices for defining the activity of the aerosols are described, and the sensitivity and applicability of the process of measurement are dealt with. (auth)

27644 ELECTRON MICROSCOPE PREPARATIONS OF RADIOACTIVELY LABELED AEROSOLS. Guenter Riedel (Kernforschungsanlage, Jülich, Ger.). Staub, 23: 237-42 (Apr. 1963). (In German)

A method is described to smear extremely thin layers of nuclear emulsion on labeled electron microscope preparations and to measure the thicknesses of these layers. Without further separation, preparation and emulsion can be observed after exposure and development in an electron microscope. The source of the tracks formed in the emulsion can be exactly identified and the size and structure determined. This method finds applications in dust research and also in the analysis of medical and biological sections. Further information can be obtained about properties of different emulsions. (auth)

27645 SILAGE DENSITY: AS MEASURED BY GAMMA ENERGY ATTENUATION. D. E. Wilkins, P. E. James, and J. R. Menear (U. S. Dept. of Agriculture, Beltsville, Md.). Preprint Paper No. 63-332. St. Joseph, Mich., American Society of Agricultural Engineers, 1963. 26p.

Paper from Annual Meeting, Miami Beach, Florida, June 1963.

The variables affecting silage density and some of the methods used for determining the density are described briefly. The principle of gamma ray attenuation and backscattering for density measurement is discussed in some detail. Exploratory tests of this technique were made using a cesium-137 rabbit in a central pipe in the silo, and a Tl-activated NaI detector outside the silo. Results are given for density measurements on hay and corn silage and for preliminary studies of the behavior of silage in the silo. (D.L.C.)

27646 CONSTRUCTION AND OPERATION OF A COMMERCIAL GAMMA-RAY PACKAGE STERILIZING PLANT. C. G. Crawford (Johnson's Ethical Plastics Ltd., Slough, Eng.). IAEA Preprint CN-14/34. 19p. (In English)

To be published in Proceedings of the IAEA Conference on the Application of Large Radiation Sources in Industry, Salzburg, Austria, May 1963).

A Co^{60} sterlizing plant now being operated commercially is described. It is a continuous process plant with a source of 50,000 C, with completely automatic operation and was designed specifically for the sterilization of disposable plastic syringes and other medical products of similar bulk density. The plant has been in operation since November 1962. A description is given of the main features of its construction, including personnel safety devices, and method of loading the source rods. Operating experience is described including dosimetry, integration of the plant into a commercial undertaking as a production process, and bacteriological results. A short discussion of the economics of sterilizing by gamma radiation is given and an assessment is made of possible future applications of a plant of this type. (P.C.H.)

27647 IRRADIATION OF HYDROCARBON OILS. Bertrand W. Greenwald and Allan K. Lazarus (Cities Service Research and Development Co.). U. S. Patent 3,094,472. June 18, 1963. Filed Feb. 17, 1960.

A process is given for improving the stability of hydrocarbon fuel oils against formation of gum and sediment during storage. The process comprises adding 0.001 to 0.1 wt % of an additive (imidazole, acetonitrile, o-benzyl phenol, or 2,6-ditertiary-butyl p-cresol) to the oil and then irradiating the mixture with 10^7 to 10^9 r of gamma rays. (D.L.C.)

27648 PREVENTION OF OFF-FLAVORS IN RADIATION-STERILIZED BEEF. Frank J. Alexander and Louis A. Harriman (to U. S. Army). U. S. Patent 3,093,489. June 11, 1963. Filed July 28, 1961.

A procedure for preventing off-flavors in the radiosterilization of beef was developed. Surrounding the beef with a saline solution of 0.85 to 4.25% strength during exposure to ionizing radiation at a dosage in excess of 1 megarad allows the off-flavors to be eluted from the beef and removed with the solution. (D.C.W.)

27649 REINFORCEMENT OF RUBBER WITH IRRADIATED CARBON BLACK. Gerard Kraus (to Phillips Petroleum Co.). U. S. Patent 3,093,561. June 11, 1963. Filed Sept. 17, 1959.

Incorporation into rubber of carbon black that was subjected to fast neutron radiation was found to produce rubber products with higher cure rates and better physical properties. The black was subjected to a total exposure of 10^{16} to 10^{18} nvt neutrons where nv is the number of neutrons/cm^2-cross section/sec and t is time in seconds. (D.C.W.)

INSTRUMENTS AND INSTRUMENTATION

General and Miscellaneous

Refer also to abstracts 28085 and 28092.

27650 (AD-297382) STUDY OF TECHNIQUES FOR A HIGH POWER, FAST WAVE PLASMA CYCLOTRON AMPLIFIER. Third Quarterly Interim Engineering Report. Edwin Langberg, Maiken Naylor, and David Park (Elcon Lab., Inc., Watertown, Mass.). Feb. 20, 1963. Contract AF33(657)-8852.

The basis of fast wave cyclotron amplification is reviewed, and research on the cyclotron gain mechanism in a gas mixture exhibiting negative differential conductivity under conditions of the d-c pumping field in the direction of the B field and the cyclotron field perpendicular to it is reported. Electron behavior of plasmas of such mixtures in magnetic fields (ambipolar diffusion, average energy, etc.) is treated. Curves giving the drift velocities for $Ar-CO_2$ and $Xe-CO_2$ mixtures are included. The $Xe-CO_2$ seems most promising for ambipolar diffusion biasing. The design of a microwave cavity that operates in the TE_{111} mode in a circular cylindrical cavity at 3 Bc, and its associated plasma tube, are discussed. The arrangement to be used in observing gain in the plasma tube is described along with the vaccuum system for the assembly. Preliminary studies of gas breakdown in a tube by a d-c voltage indicate a plasma with a quiet mode of operation and with no instabilities. Nonuniformity of the plasma and cathode sputtering were, however, observed, but were overcome by exciting the plasma by r-f osscillations. The TE_{111} mode was observed in the cavity without the plasma tube at 3.00 Bc; with the plasma tube the TE_{111} modes appeared at 2.860 and 3.040 Bc. A d-c discharge in the plasma tube resulted in cathode sputtering that damped out the desired mode. This was overcome by r-f excitation of the plasma. (D.C.W.)

27651 (GEAP-4135) THE MEASUREMENT OF FREE FISSION GAS PRESSURE IN OPERATING REACTOR FUEL ELEMENTS. M. B. Reynolds (General Electric Co. Vallecitos Atomic Lab., San Jose, Calif.). Jan. 23, 1963. Work Performed under United States-Euratom Joint Research and Development Program. Contract AT(04-3)-189. 36p. (EURAEC-627)

A differential-type pressure transducer suitable for use in a fast neutron environment at elevated temperatures was developed. The sensitivity of this device is ~0.25 psi with the ability to withstand an unbalanced pressure of over 1500 psi from either direction. A number of stainless steel-clad UO_2-filled fuel rods were irradiated in the Vallecitos Boiling Water Reactor to exposures in excess of 3000 Mwd/t. The experiments indicated that fission gas release is negligible from UO_2 operated below the recrystallization temperature. For operation at higher power levels the fractional fission gas release is directly comparable to the volume fraction of fuel operating above the recrystallization temperature. (auth)

27652 (HW-SA-3036) MONITORING SURFACE TEMPERATURE OF IRRADIATED FUEL ELEMENTS. R. G. Clark (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). May 6, 1963. Contract AT(45-1)-1350. 79p.

A radiation thermometer using infrared techniques was developed to monitor surface temperatures of irradiated fuel elements while undergoing physical examination. Thermistors were chosen as sensors for the infrared thermometer as they are the most responsive transducer in the temperature range of interest here, namely from 600 to 100°F, and possess the required tolerance to gamma radiation which will be present at dose rates to 10^6 r/hr. A response unaltered by either short term or long term effects from this radiation required that all materials used in the probe be radiation tolerant, including infrared lenses as well as thermistors. A gamma radiation damage program was initiated to provide information on the radiation tolerance of silicon, germanium, and arsenic trisulfide lens materials. It was determined that these materials would suffer no damage and would not darken or change transmiąsion characteristics from exposure to high-energy gamma radiation accumulated up to 10^9 r. The probe design resulted in a small, evacuated, tube-like shell, one inch in diameter with a parabolic reflecting mirror and an arsenic trisulfide lens at one end. Two thermistor beads were used, with one at the focal point of the mirror to sense the source and the second in the rear to monitor changes in ambient temperatures. A simple bridge circuit was employed in a manner that corrected for changes in ambient temperatures that would be great enough to affect the response of the sensing thermistor bead. Commercial temperature indicating equipment was modified to provide a meter for remote temperature indication and power for bridge excitation for the thermistor circuit. It was shown that the response of the device would not be affected by changes in emissivities among fuel elements. The expected response of the probe was determined in essentially an energy balance analysis and experimental results confirmed the predicted results. From this correlation, it was concluded that the device will perform essentially as a radiation thermometer and that no unusual response will occur. (auth)

27653 (IDO-16852) THE DESIGN OF A POTENTIOSTAT FOR ELECTROCHEMICAL RESEARCH. R. H. Brown (Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho). May 6, 1963. Contract AT(10-1)-205. 42p.

Activities in a program to develop better electrochemical methods for recovery of U^{235} from spent nuclear reactor fuel elements are reported. Included are descriptions of investigations concerning narrow bandwidth potentiostats, wide-bandwidth potentiostats, a 10 to 15 db/decade network, and amplifier improvements. (J.R.D.)

27654 (LADC-5535) NUMERICAL AND EXPERIMENTAL STUDY OF DAMPED OSCILLATING MANOMETERS. I. NEWTONIAN FLUIDS. John C. Biery (Wisconsin. Univ., Madison). [1962]. Contract [W-7405-eng-36]. 48p.

The time dependent behavior of Newtonian oscillating manometers was studied experimentally and mathematically. The manometers were simulated by numerically integrating the axial component of the equation of motion in cylindrical coordinates. Modifications in the driving force term were made to include effects of surface tension and flow reversal. The integrations showed that the velocity profiles in the manometer were not parabolic and contained many maxima and minima, particularly when the

fluid had a low viscosity. Good agreement was obtained between experimental and simulation frequencies and damping factors. (auth)

27655 (NAA-SR-Memo-6117) LIQUID METAL FLOWMETER OF THE E-CORE FLUX DISTORTION TYPE. C. G. Bergdorf (Atomics International. Div. of North American Aviation, Inc., Canoga Park, Calif.). Feb. 8, 1961. Contract [AT(11-1)-Gen-8]. 12p.

The E-core, flux-distortion type, electromagnetic flowmeter was evaluated to determine its suitability for Na systems. The flowmeter was found to provide a method for observing changes in Na flow, but its sensitivity decreased as pipe wall thickness increased. Output voltage appeared to be a linear function of the flow over the range tested, and there appears to be no temperature effect problem. Susceptibility to currents other than those of the primary winding, necessity for high temperature insulation on the winding wires, and difficulty in maintaining a null voltage point for zero flow were also noted. (D.C.W.)

27656 (NYO-9854) INVESTIGATION OF RADIOISOTOPE TECHNIQUES FOR ATMOSPHERIC DENSITY MEASUREMENTS AND THE DEVELOPMENT OF A DEVICE. Final Technical Report. Charles A. Ziegler, Leonard L. Bird, and Roy Rex (Parametrics, Inc., Waltham, Mass.). Oct. 12, 1962. Contract AT(30-1)-2795. 85p.

An attempt was made to determine the feasibility, and the optimum design, of an atmospheric density gauge using radioisotope techniques for use in a balloon sonde at altitudes up to 140,000 ft. Methods considered were: electron-induced optical fluorescence, electron-bremsstrahlung, alpha range-energy, gamma and x-ray attenuation and scattering, and beta attenuation and scattering. Of these, beta scattering was found superior on the basis of cost, simplicity of apparatus and minimal required source strength. Design requirements associated with the beta scatter gauge such as type of source, source-shield-detector geometry, type of detector, background compensation, and the necessary electronic circuits were determined for optimum gauge performance. It is possible to make a beta scatter gauge for balloon sonde use that will provide a measurement of atmospheric density to better than 1% from 45,000 to 140,000 ft using several millicuries of krypton-85 as a source. This gauge can be made compatible with the present Weather Bureau sonde and ground station equipment. The design, construction, calibration and flight test of such a sonde were undertaken as part of this work, and the results of balloon flight tests are presented. (auth)

27657 (UCRL-6886(Rev.1)) A METHOD FOR SUPPRESSING PHOTOMULTIPLIER NOISE. R. W. Hill and J. P. Stoering (California. Univ., Livermore. Lawrence Radiation Lab.). Jan. 1, 1963. Contract W-7405-eng-48. 8p.

The system was designed to take advantage of the difference in pulse length of slow-decay-time scintillators, such as CsI(Tl) and NaI(Tl), and the photomultiplier noise. The design has the advantage of simplicity and of using mostly standard electronic components, and is similar to the pulse shape discriminator system used to distinguish particle types. A typical spectrum obtained using the suppressor with a 6-kev x ray from Fe^{55} on a CsI(Tl) crystal mounted on an RCA 6801A photomultiplier is shown. (B.O.G.)

27658 (UCRL-10473) A D-C TRANSFORMER WITH LOW NOISE AND WIDE FREQUENCY RESPONSE. Alfred A. Windsor (California. Univ., Berkeley. Lawrence Radiation Lab.). Sept. 19, 1962. Contract W-7405-eng-48. 16p.

A circuit for the simple series-connected saturable reactor corrects some fundamental limitations in stability, response time, and signal-to-noise ratio. The transformer maintains continuous ampere-turn balance between primary and secondary and excels conventional circuits when stability and wide frequency response are important. (auth)

27659 AMPLITUDE DISTRIBUTION OF PHOTOMULTIPLIER SINGLE ELECTRON RESPONSE. M. Bertolaccini and S. Cova (INFN, Milan). Energia Nucl. (Milan), 10: 259-67(May 1963). (In English)

An experimental study was made of the amplitude distribution of photomultiplier anodic pulses, arising from individual electrons emitted by the cathode. The overall distribution differs from the expected one for electrons starting from the photocathode, on account of contribution of chains originating from dynodes owing to thermoelectronic emission. If chains originating from the photocathode are selected for the measurements, the distribution agrees remarkably well with theoretical results of Janossy and of Lombard and Martin. The agreement is good if care is taken that other statistical phenomena, such as electron selection through focalization effects are not involved in the multiplication mechanism. The accuracy of evaluating the gain of the photomultiplier through the integral amplitude distribution of output pulses under weak illumination as suggested by Colgate is discussed. (auth)

27660 FAST SCALING CIRCUIT. D. T. Stewart and P. Martin (Univ. of Glasgow). J. Sci. Instr., 40: 329(June 1963).

A fast scaler with a large storage capacity was developed in order to fulfil the requirements for a random counting rate of 10^5/sec with a capacity of 10^9. In this scaler, pulses from the alpha counter drive a fast trigger circuit to produce pulses which are presented to one input of a fast coincidence unit. Standard pulses are fed at a constant rate to the other input. The output is coupled to a conventional Dekatron scaling unit. The overall resolving time and scaling factor were found to be 145 nsec and 552, respectively. (D.L.C.)

27661 THE USE OF ELECTROSTATIC HIGH-VOLTAGE GENERATORS IN NUCLEAR PHYSICS. N. Felici (Université, Grenoble, France). Neue Tech., 5: 257-64(May 1963). (In German)

The use of electrostatic generators in nuclear physics is discussed. The Van de Graaff or belt generator gives the highest voltages in electrical engineering, i.e., 6 to 10 Mv. The invention of the "tandem" accelerator further increased the scientific value of the belt machine, since it is likely to give ion energies up to 30 Mev by resorting to voltages which are only one half or even one third of that figure. The cylinder machine with hydrogen insulation extends the range of electrostatic generation towards higher currents (up to 50 ma) and powers (10 kw). It has found broad acceptance for many applications in the voltage range 50 to 1000 kv. (auth)

27662 DETERMINATION OF LONGITUDINAL SHOCK WAVE PROFILES IN A MICROWAVE FABRY-PEROT INTERFEROMETER. Efraim Ravid (Hebrew Univ., Jerusalem). Phys. Fluids, 6: 1026-7(July 1963).

A method that takes into account the longitudinal permittivity distribution in the shock tube, for the calculation of the phase and amplitude of an electromagnetic wave

emerging from an interferometer etalon is presented. (C.E.S.)

27663 LIQUID-GAS FILM CALORIMETER FOR DEFORMATION OF METALS. R. O. Williams (Oak Ridge National Lab., Tenn.). Rev. Sci. Instr., 34: 639-43(June 1963).

A device was constructed for measuring the changes in internal energy of metals and alloys during deformation. The basis of the method is the quantitative utilization of the heat released in the sample to vaporize a pure liquid under equilibrium conditions, and measurement of the volume of gas produced. The liquids which are used are N_2, CCl_2F_2, and CCl_3F, having boiling points of -196, -30, and 24°C, respectively. (auth)

27664 INTEGRATOR FOR SMALL PULSED AND DIRECT CURRENTS. E. J. Rogers (Brookhaven National Lab., Upton, N. Y.). Rev. Sci. Instr., 34: 660-3(June 1963).

A solid-state electronic integrator capable of integrating and digitizing small currents was developed. In a recent experiment, pulsed proton beams with an average value of 10^{-9} amp were integrated and measured with a 0.1% accuracy. Pulsed or direct currents can be measured accurately down to a lower limit imposed by uncompensated variations of the order of 10^{-13} amp in input leakage current. The current to be integrated is applied to a Miller integrator circuit which employs a commercially available solid-state operational amplifier. A diode-switched charging circuit gated on and off by the integrator output voltage "pumps down" the integrator capacitor with discrete units of negative charge, simultaneously delivering digital output pulses to an external counter. An output voltmeter provides analog readout of residual fractional charge increments. (auth)

27665 HIGH VELOCITY DRIVE FOR MÖSSBAUER EXPERIMENTS. R. L. Cohen, P. G. McMullin, and G. K. Wertheim (Bell Telephone Lab., Inc., Murray Hill, N. J.). Rev. Sci. Instr., 34: 671-3(June 1963).

A drive capable of producing controlled velocities in excess of 100 cm/sec is described. The drive consists of a loudspeaker "motor" coupled to a velocity transducer. Feedback is used to make the velocity follow an input waveform accurately. The system uses standard parts and is easy to build. (auth)

27666 FOUR-WINDOW CELL AND CRYOSTAT FOR HIGH PRESSURE STUDIES AT LIQUID HELIUM TEMPERATURE. D. B. Fitchen (Univ. of Illinois, Urbana). Rev. Sci. Instr., 34: 673-6(June 1963).

A compact gas high pressure cell for measuring the optical properties of solids at low temperatures under pressures up to 10 kilobars is described. Using helium gas as the pressure-transmitting medium, the pressure is purely hydrostatic at 78°K and nearly hydrostatic at 7 to 12°K. Techniques are discussed for sealing windows of sapphire for optical studies, of beryllium for x irradiation, and dummy windows for electrical connections. A cryostat which can be accommodated in most recording spectrophotometers is also described. (auth)

27667 IONIZATION VACUUM GAUGE WITH PHOTOCURRENT SUPPRESSION. W. C. Schuemann (Univ. of Illinois, Urbana). Rev. Sci. Instr., 34: 700-2(June 1963).

A new ionization vacuum gage with suppression of the photoelectric current from the ion collector was developed for the measurement of very low pressures. The gage, which is similar to a standard Bayard-Alpert gage, includes a suppressor ring and a shield electrode. The shield electrode shields the suppressor ring, ion drift region, and collector region and forms an electrostatic lens with the grid for accelerating and focusing the ions on the collector. The gage is linear over the range of pressures of 10^{-6} to 10^{-10} Torr. (D.L.C.)

27668 MASS SPECTROMETRIC DETERMINATION OF IONIZATION PRESSURE GAUGE SENSITIVITIES. Harlan U. Anderson (Univ. of California, Berkeley). Rev. Sci. Instr., 34: 703-4(June 1963).

A new method was devised for calibrating ion gages for measurements of pressures of gases other than N_2. A mass spectrometer signal is obtained as a function of the apparent pressure in the ion gage. A high-pressure mixture of N_2 and some other gas of known composition is allowed to leak into the system to establish a steady-state pressure, and the resulting mass spectrometer is used to compute the sensitivity of the gage to the second gas. The sensitivities to Ar, CO, O_2, and NO were measured relative to N_2 and compared with other literature values. (D.L.C.)

27669 REPORT ON THE SCIENTIFIC INTEREST AND PROBLEMS. P. Swings (Institut d'Astrophysique, Liège). Space Sci. Rev., 1: 762-73(May 1963). (In English)

Spectroscopy and its application in the field of space research is discussed. Possible information that may be gained by x-ray, gamma, infrared, and ultraviolet spectra is discussed. The problems associated with space research spectroscopy are considered. The problems include present limitations, higher resolution, and suppression of the bright sky foreground. (C.E.S.)

27670 A SIMPLE LOW-TEMPERATURE CAMERA FOR X-RAY SPECTROGRAPHY WITH HORIZONTAL AXIS OF ROTATION. Lothar Meyer (Univ. of Chicago). Z. Angew Phys., 15: 438-40(May 1963). (In German)

A low-temperature camera for crystal structure investigations by x-ray spectrography is described. It is relatively simple to produce and can be dismantled and reassembled in a few minutes. With a filling of one liter of liquid hydrogen, a work time of about 3 hours is possible. (tr-auth)

27671 THE PRODUCTION OF VERY SHORT AND INTENSIVE UV LIGHT PULSES. L. Frommhold (Universität, Hamburg). Z. Naturforsch., 18a: 590-3(May 1963). (In German)

A Kerr-cell-controlled spark light source for the production of 5×10^{-9} sec light pulses is described. The quartz ultraviolet region down to 1900 Å wavelength may be transmitted using water as Kerr cell liquid. Some properties of a water-filled Kerr cell are discussed. The Kerr constant was found to be 10×10^{-7} esu at wavelengths between 2100 and 3000 Å. (auth)

27672 MOBILE GAMMA IRRADIATORS FOR FRUIT PRODUCE (Engineering Materials). (Associated Nucleonics, Inc., Garden City, N. Y.). 11 units. (CAPE-944)

Mobile irradiators used for the radiopasteurization of strawberries, grapes, peaches, tomatoes, and lemons are described. The irradiators are mounted on trailers and each irradiator, including the trailer, weighs 70 to 80 tons. Radiation doses range from 100,000 to 200,000 rads. Minimum production is 500 lb of fruit per hour. Drawings are included for four types of irradiators: the single-slab two-pass, double-slab one-pass, single-slab four-pass, and line-source rotary. In the single-slab two-pass system, the packages make two passes in front of the source. The length of the packages is parallel to the direction of travel. The packages are irradiated on each side. This system is light in weight, has low capital cost, and is simple to fabri-

cate. The double-slab one-pass system is the same as the above except the source strength is doubled and irradiation time is cut in half. The same arrangement is used in the single-slab four-pass system that is used in the single-slab two-pass system except the packages make two passes on each side of the source. The rotary system combines a linear and rotary motion to provide high dosage. It uses a small Co^{60} source but costs more than a single-slab two-pass system. (F.E.S.)

27673 TWO DIMENSIONAL PULSE HEIGHT ANALYZER (Engineering Materials). (Brookhaven National Lab., Upton, N. Y.). 20 units. (CAPE-866)

A multichannel kicksorter was designed for two-dimensional sorting. It can also be used to study decaying sources and any system where the change in the spectrum with time is of interest. The input signals are in the range of 0 to 100 v with an impedance of 10,000 ohms. The instrument contains circuits for converting amplitude information into digital addresses, a memory of suitable speed, a spectrum display, and provision for data print out. (F.E.S.)

27674 HDIX SPECTROMETER (Engineering Materials). (Brookhaven National Lab., Upton, N. Y.). 43 units. (CAPE-863)

The HDIX spectrometer used for neutron-diffraction experiments to study single c_ystal and powder samples is described. Accessories such as magnets, cryostats, and furnaces can be accommodated. The components are the first crystal shield, the goniometer, the pedestal, the diffractometer, and the counter shield. The first crystal shield houses the first or monochromator crystal and attenuates all incident rays, except the selected monochromatic beam which passes through an exit collimator. The goniometer is located in the shield and allows 3 dimensional alignment of the first crystal. The pedestal supports the shield and the diffractometer and rotates about a vertical axis to orient the diffractometer in the path of the monochromatic beam. The diffractometer supports the sample and measures the angular relationship between the monochromatic beam, the sample, and the counter. Drives allow either continuous or step scanning. The counter shield houses the BF_3 proportional counter and a collimator. (F.E.S.)

27675 METHOD AND DEVICE FOR STABILIZING THE GAIN OF PHOTOMULTIPLIER TUBES. Arthur Marcel Gouyon, Marcel Kermagoret, and Andre Pascal (to Commissariat a l'Energie Atomique). British Patent 927,757. June 6, 1963. Priority date Dec. 16, 1958, France.

The gain of a photomultiplier tube with n dynodes located between the anode and the photocathode can be stabilized by feeding n-1 dynodes from a voltage divider connected to the high voltage source supplying the anode and photocathode and by feeding a stabilizing voltage to the remaining dynode through a prescribed network connected between the voltage source terminals. Adjustment of the network is very simple. (D.C.W.)

27676 IMPROVEMENTS IN OR RELATING TO DEVICES FOR REMOTE MEASUREMENT OF THE DISPLACEMENTS OF INACCESSIBLE MEMBERS. Marc Alfred (to Commissariat a l'Energie Atomique). British Patent 927,883. June 6, 1963. Priority date Feb. 5, 1960, France.

A device for remotely determining the position of an inaccessible movable member (control rods, for instance) utilizes a stem of magnetic material attached to the member, the movement of which is monitored by pairs of primary and secondary windings that feed voltages related to the position to a receiver. (D.C.W.)

27677 IMPROVEMENTS IN OR RELATING TO COUNTING APPARATUS. (to Commissariat a l'Energie Atomique). British Patent 928,797. June 12, 1963. Priority date Dec. 15, 1959, France.

An apparatus for counting electrical pulses occurring at intervals of a hundred thousandths of a second or less is described. The device for counting at high speeds is adapted for counting in a positive sense; the device for lower frequencies is adapted for counting in a negative sense. Electrical transfer pulses are applied to both devices, and the application of transfer pulses is terminated by gating means in response to a predetermined condition of the fast counter. (D.C.W.)

27678 IMPROVEMENTS IN DEVICES FOR MEASURING MAGNETIC FIELDS, EVEN OF LOW INTENSITY, AND, IN PARTICULAR, THE EARTH MAGNETIC FIELD. Anatole Abragam, Jean Combrisson, and Ionel Solomon (to Commissariat a l'Energie Atomique). British Patent 929,022. June 19, 1963. Priority date Jan. 30, 1959, France

A magnetic resonance device is designed for measuring weak magnetic fields. The device comprises a container with a solution consisting of a solvent of nonzero gyromagnetic ratio and a paramagnetic solute of stationary hyperfine structure with a narrow electronic resonance line, means for saturating the resonance line and for creating a rotary magnetic field perpendicular to the field being measured, and means for determining the resonance frequency. (D.L.C.)

27679 DISPLAY DEVICE FOR USE IN INSTALLATIONS FOR CYCLICALLY CHECKING, BY MEANS OF A LIMITED NUMBER OF APPARATUS, THE VALUES OF A MAGNITUDE AT A MULTIPLICITY OF POINTS. Roland Cochinal, Jean Goupil, and Jean Megy (to Commissariat a l'Energie Atomique). U. S. Patent 3,093,003. June 11, 1963. Priority date Jan. 27, 1958, France.

A display device for cyclically checking values of a physical magnitude at a number of points with a limited number of apparatus is described. A cyclical switching device permits successive and repeated determinations. Two indicator elements are driven in synchronism with the switching device, one of which stops when a determination by the apparatus exceeds a given limit value. (D.C.W.)

27680 METHOD FOR DETERMINING FLUID FLOW IN A CONDUIT. John P. Danforth and Robert E. Black (to General Motors Corp.). U. S. Patent 3,093,739. June 11, 1963. Filed Mar. 10, 1958.

A radioactive tracer technique for detecting leaks in conduits or for determining the flow path, rate, and direction in conduits without introducing harmful radioactivity is described. A radioactive material is enclosed in a capsule that is weighted to have the same average density as the fluid in the conduit; tracing its movement yields the desired information. (D.C.W.)

27681 DENSITY MEASURING APPARATUS PROVIDING A SUBSTANTIALLY PURE BEAM OF RADIATION FROM COMPOSITE SOURCES. Neil E. Handel (to Industrial Nucleonics Corp.). U. S. Patent 3,094,622. June 18, 1963. Filed June 30, 1959.

An improved bremsstrahlung source is designed for use in thickness gages. The source comprises a thin target positioned in the path of beta particles from a radioisotope, whereby gamma rays are transmitted through the target while the generated bremsstrahlung is issued in all directions. Thus, uncontaminated bremsstrahlung may be obtained. (D.L.C.)

Radiation Detection

27682 (EUR-14.i) NUOVA STRUMENTAZIONE PER MISURE DI FISICA SANITARIA. (New Instrumentation for Health Physics' Measurements). A. Anzani, A. Malvicini, and M. Salvini (European Atomic Energy Community. Nuclear Research Center, Ispra, Italy). June 1962. 16p.

Reasons for designing and producing new transistorized instruments for health physics' measurements are described. Schematic diagrams of circuits' logic are outlined and technical data of new instruments are reported. (auth)

27683 (HW-66728) A PERFORMANCE STUDY OF MINIATURE GLASS DOSIMETERS. P. E. Bramson (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Oct. 24, 1960. Contract AT(45-1)-1350. 22p.

The Bausch and Lomb silver phosphate glass dosimetry system was studied for possible integration into the Hanford radiation dosimetry program. The 1 × 6 mm glass dosimeters (fluorods) are best suited for measurement of gamma exposure in the 5 to 1.5×10^4 r range. The fluorod exhibits considerable energy dependence for both gamma and beta radiation. Fast neutron and alpha sensitivity is negligible. Thermal neutron sensitivity is significant – about 1.4 times the 1 Mev gamma sensitivity. The fluorod is essentially dose rate independent, directional independent, temperature independent and has a very low background fluorescence. Maximum fluorescence of an exposed fluorod is attained within about three hours after exposure. Fading reduces the fluorescence to about 70% of its maximum value in 120 days. Exposed fluorods can be reclaimed by heat annealing. The dose range of the fluorod and the simplicity of the measurement technique makes it especially adaptable for rapid evaluation of high gamma doses. (auth)

27684 (HW-67376) IN-CELL BETA-GAMMA MONITOR INSTRUCTION MANUAL. E. M. Sheen (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Nov. 11, 1960. Contract AT(45-1)-1350. 9p.

Two radiation monitoring instruments are described for use in high radiation level cells. The first instrument is designed for gamma radiation monitoring ranging from 2×10^2 to 2×10^6 r/hr full scale. The second instrument has beta-gamma sensitivity, and is for low-level use during cell decontamination after experiment completion. (auth)

27685 (LA-2860) HOWARD EBERLINE NEUTRON SURVEY INSTRUMENT PNC-1; EVALUATION AND RECOMMENDATION FOR USE. E. R. Graves (Los Alamos Scientific Lab., N. Mex.). Mar. 1963. Contract W-7405-eng-36. 34p.

A Howard Eberline Neutron Survey Instrument, PNC-1, was evaluated for use as a neutron survey instrument. The sensitivity as a function of neutron energy was measured for neutron energies from 10 kev to 14 Mev. The calibration measurements are described. The application of the instrument to neutron monitoring is discussed, and a recommendation for convenient usage leading to rem per hour dose rates is given. (auth)

27686 (NIRL/R/14) THE GEOMETRICAL RECONSTRUCTION OF BUBBLE CHAMBER TRACKS. J. W. Burren and J. Sparrow (Gt. Brit. National Inst. for Research in Nuclear Science. Rutherford High Energy Lab., Chilton, Berks, England). Feb. 1963. 55p.

The geometrical reconstruction program of the Rutherford Laboratory bubble chamber analysis system is described. The program uses a two-stage process to reconstruct the tracks in space. In the first stage a circle is fitted to the space points on the track found by the method of corresponding points. The results of this fit are used to fit a helix to the rays of all three views of the track. The helix is given a mass-dependent correction to allow for the slowing down of the particle in the chamber liquid. The program is built into a library and book-keeping system, which is described. (auth)

27687 (NIRL/R/30) TOROIDAL TRANSFORMERS AND PRE-AMPLIFIERS FOR TRANSPARENT BEAM-CURRENT MONITORS. J. T. Hyman (Gt. Brit. National Inst. for Research in Nuclear Science. Rutherford High Energy Lab., Chilton, Berks, England). Mar. 8, 1963. 21p.

The fundamental design of toroidal transformers, preamplifiers, and other associated equipment intended for monitoring pulsed beams of charged particles is considered. Details of the NIMROD Injector Beam Monitoring Systems are given. (auth)

27688 POINT AIR-FLOW COUNTER AS AN EXO-ELECTRON DETECTOR. Ignacy Stepniowski (Pedagogical Coll. of Opole, Poland) and Bogdan Sujak. Acta Phys. Polon., 23: 431-8(Apr. 1963). (In English)

The possibility of using a point air-flow counter for the detection of exo-electrons was investigated. If vapors of liquids flow through the counter, the counter reacts to electrons and negative ions with large pulses for a relatively small operating voltage. The following liquids were investigated: ethyl alcohol, n-propyl alcohol, n-butyl alcohol, and dioxane. (auth)

27689 GENERAL APPLICABILITY OF THE CHANNELS RATIO METHOD OF MEASURING LIQUID SCINTILLATION COUNTING EFFICIENCIES. Elizabeth T. Bush (Nuclear-Chicago Corp., Des Plaines, Ill.). Anal. Chem., 35: 1024-9(July 1963).

Determination of the counting efficiencies of liquid scintillation samples as a function of the ratio of the count rates in two channels of the pulse height spectrum is examined for a much wider variety of quenching agents, solvent systems, and fluor concentrations than previously reported. The behavior of the curves of efficiency vs channels ratio is examined as a function of small changes in multiplier phototube and discriminator voltages and other instrumental variables, and the overall accuracy of the method is assessed. It is concluded that the method is much more widely applicable than is generally realized and that extremely useful results are obtainable when instrumental parameters are properly chosen. (auth)

27690 NEW TYPES OF HALOGEN COUNTERS. Helwig Gebauer (Friesecke und Hoepfner, GmbH, Erlangen-Bruck, Ger.). Arch. Tech. Messen, Lfg., 317: 129-30 (June 1962). (In German)

The advantages of halogen counters over Geiger counters are discussed. Four types of counters are illustrated with respect to their structural and functional capabilities: a bell-shaped low-level β-counter with large radius of curvature for the anode is described that has the desired characteristics of maintaining a negligible zero effect for the β-sensitive end-window counting tube; a counter with a large measuring range that is achieved by connecting 2 or more counters with different sensitivities in parallel; or, by replacing the conventional cylindrical counting tube by a conical one; a counter with a liquid anode consisting of 2 or 3 drops of concentrated H_2SO_4 in 100 cc of H_2O, and a Cu-wire spiral cathode wound on a glass ampoule filled with

100 mm Hg of Ar and 0.2 mm Hg of Br_2; and the so-called pancake counters having very high sensitivity for both α and β radiation due to the cathode height being small in relation to the diameter. A slight modification of Anton's pancake counter makes a window-diameter of up to 6 in. possible through the use of a support for the mica plate. The γ sensitivity of this type is only 0.2%. (OID)

27691 WHOLE-BODY COUNTER. Magda Harmut (Inst. of Medical Research and Occupational Medicine, Zagreb). Arhiv Hig. Rada i Toksikol., 13: 251-61(1962).

A review is presented on whole-body counters. The time of recording required and the standard error (μg Ra and per cent of K^{40} in body) are tabulated for 10 previously published works. (TCO)

27692 DOSIMETRY OF FAST NEUTRONS WITH NUCLEAR TRACK FILMS. E. Piesch (Kernforschungszentrums, Karlsruhe, Ger.). Atompraxis, 9: 179-88(May 1963). (In German)

In the dosimetry of fast neutrons with nuclear track films, the following methodological problems arise: 1. dependence of track number upon neutron energy; 2. coordination of track number and dose; 3. influence of the body on the reading of the personal dosimeter; 4. possibility of using nuclear track film for neutron energies of over 14 Mev. The demonstrational probability and dose coordination are derived in their relation to neutron energy, and the results are applied to various known neutron spectra as well as to a random sampling of energy distributions. The influence of the body on dose determination was ascertained experimentally with the aid of a dummy. From this, estimates were made of the margins of methodological error in using nuclear track films for neutron dosimetry. (auth)

27693 THE EMIA-1 ALPHA PULSE CHAMBER. Simone Vuccino (Faculte des Sciences, Reims). Ind. At., 7: No. 3-4, 121-3(1963). (In French)

The EMIA-1 pulse ionization chamber is designed for the absolute measurement of the α activity of sources, where the intensity is of the order of several tenths of a microcurie. The apparatus is easy to operate and gives reproducible results. The characteristics of the EMIA-1 are reported, and a schematic is given. (J.S.R.)

27694 A VISE-CONFIGURATION β-COUNTER. DETERMINATION OF TOTAL EXCHANGEABLE POTASSIUM USING A LOW DOSE OF ISOTOPE. E. A. Boling (Veterans Administration Hospital, Boston and Tufts Univ., Boston). Intern. J. Appl. Radiation Isotopes, 14: 177-82(June 1963). (In English)

A β-ray counter in the form of a vise is described. A liquid sample is placed between the two jaws in a novel sample holder. Geometry is extremely reproducible. Efficiency is 28% for K^{42} in aqueous samples of 80 ml volume. Liquid samples containing K^{42} in concentrations as low as 10^{-5} μc/ml may be conveniently assayed with high accuracy. Results are given for measurement of total exchangeable potassium in man using a dose of only 10 μc of K^{42}, and collecting equilibrium samples 40 and 44 hr after tracer administration, at which time the body burden would be 1 μc or less. (auth)

27695 COMPENSATED-SURFACE OXIDE-PASSIVATED SILICON JUNCTION RADIATION DETECTORS. William L. Hansen, Frederick S. Goulding, and Robert P. Lothrop (Univ. of California, Berkeley). J. Appl. Phys., 34: 1570-1(May 1963). (UCRL-10578)

A semiconductor detector was constructed for operation as a guard-ring detector. Oxide passivation is used to protect the junction edges, and diffusion of Ga acceptor impurity into the Si surface is used to compensate for the donors introduced by the oxide growth. Resolution of α-particle spectra is typically 17 kev for 1-cm-dia detectors made in this way, and they are much less sensitive to ambient conditions than other types of detectors. (D.L.C.)

27696 RADIATION DOSIMETRY IN POLYETHYLENE WITH SILICON SOLAR CELLS. R. Salovey and W. Rosenzweig (Bell Telephone Labs., Murray Hill, N. J.). J. Polymer Sci., Pt. A, 1: 2145-54(June 1963). (In English)

Irradiation dose rates and complete depth–dose curves in polyethylene were directly determined with a silicon solar cell. In this manner, an average dose rate of 0.297 Mrad/sec per incident $\mu a/cm^2$ for 1 Mev electrons in 120-mil thick Marlex polyethylene was measured. The corresponding dose rate ascertained by ferrous sulfate dosimetry is 0.260 Mrad/sec. This difference is in the expected direction and may arise from differences in backscatter between polyethylene and silicon. The facility of the solar cell measurement and the complete definition of irradiation dose as a function of absorber thickness commend the device for general application in irradiation dosimetry. (auth)

27697 AN ANALYSIS OF THE CHARACTERISTICS OF A NEON-ALCOHOL SPARK CHAMBER. J. U. Burnham, I. W. Rogers, M. G. Thompson, and A. W. Wolfendale (Univ. of Durham, Eng.). J. Sci. Instr., 40: 296-302(June 1963).

The characteristics of a spark chamber containing a neon–alcohol mixture are described with particular reference to the variation of efficiency with the parameters of the pulse and the determination of the spark formation time. An interpretation of the characteristics is made on the basis of a model for spark formation and the validity of the mechanism is examined by an internal comparison of the data. The results are used to derive the electron drift velocity as a function of field over the range of E/p from 0.05 to 4 v $cm^{-1}(mmHg)^{-1}$ and to determine the probability of a single electron initiating a spark. Measurements are also reported on the geometrical properties of the sparks and conditions are studied both for minimizing the angle between the direction of a particle trajectory and the ensuing spark, and for reducing the error in location of the trajectory. (auth)

27698 A SOFT γ-RAY ABSORPTION METER FOR RADIATION SAFETY MEASUREMENTS. István Erdélyvári. Magy. Tud. Akad. Kozp. Fiz. Kut. Int. Kozlemen., 10: 305-14(1962). (In Hungarian)

An absorption meter designed to determine the average energy levels of soft γ radiation consisting of components of unknown energy levels is described. It measures the variation in radiation intensity in terms of the absorber thickness from which the total absorption coefficient is calculated using the method of least squares. The energy levels are then determined from the measured absorption coefficients. The apparatus was used to determine the average energy level of soft γ radiation in the neighborhood of 600 kv and a 800 kv Cockcroft-Walton (cascade-type) accelerator. The chosen shield thicknesses were based on the obtained results and found to be adequate. (OID)

27699 STUDY ON STEM LEAKAGE OF IONIZATION CHAMBER. Minoru Nakamura, Noriyuki Koda, and Takeshi Kato (Shiohama Hospital, Japan). Nippon Hoshasen Gijutsu Gakkai Zasshi, 18: 12-16(June 1962). (In Japanese)

Tests were carried out to measure the radiation dosages in order to estimate and minimize the range of error due

to stem leakage. Several types of x rays and Co^{60} γ rays were measured by a Victoreen condenser. Results obtained when the whole chamber was irradiated were compared against those obtained by irradiating only the ionization chamber. It was observed that the error range was greatly reduced when the charge-terminal of the stem was insulated. The error range increased with higher dosages and harder rays. An error of 60% can be reduced to only a few % when the change-terminal is packed with the insulator. (OID)

27700 THE SPARK CHAMBER. Daniel Blanc and Paul Laborie (Faculte des Sciences, Toulouse). Nucleus (Paris), 4: 126-35(Mar.-Apr. 1963). (In French)

The spark counter, a precursor of the spark chamber, is described briefly in order to show the evolution of the spark chamber. The actual form of the spark chamber and its associated electrical circuitry are discussed. The principal characteristics of this detector – high voltage pulse, latency time, sensitivity time, dead time, magnetic field, efficiency, precision, and operational life – are described. Some examples of the application of the spark chamber are given in conclusion. (J.S.R.)

27701 STUDIES ON GLASS SCINTILLATOR FOR γ-RAY DETECTION. Tetsurō Izumitani and Takamichi (Takamiti) Kawamoto. Osaka Kogyo Gijutsu Shikenjo Kiho, 13: 24-33(Jan. 1962). (In Japanese)

Attempts were made to obtain glasses with high pulse heights and stability in devitrification. Samples of Li–Mg–Si glasses containing $Ce^{+}O_2$ were melted under reducing conditions in the gas furnace between 1400 and 1500°C. The pulse heights were measured by the conventional method using Cs^{137} for γ and Sr^{90} for β sources. The decay times and absorptions were also determined. The results indicated that the pulse heights of the glasses can be increased by the addition of CeO_2 only up to 1.6 wt % because the Ce^{3+} ions act as a phosphor of the scintillation glasses during reduction. The addition of As_2O_3 is also effective. Pulse heights are decreased in the presence of impurities such as Fe ions; hence, better results are obtained when glasses are melted in a quartz crucible. The (approximate) composition of a glass recommended is 80% SiO_2, 9% Li_2O, 7% MgO, 4% Al_2O_3, 4% K_2O or Na_2O, 1.6% CeO_2, and 0.5% As_2O_3 by weight. (OID)

27702 MULTIPLICATION PHENOMENON FOR FISSION FRAGMENT RESPONSE IN SEMICONDUCTOR DETECTORS. H. C. Britt and H. E. Wegner (Los Alamos Scientific Lab., N. Mex.). Rev. Sci. Instr., 34: 627-32 (June 1963).

A multiplication phenomenon caused by fission fragments has been observed in 300Ω-cm gold surface barrier detectors when operated at bias voltages greater than 100 v. This phenomenon occurs only for fission fragments that penetrate beyond some threshold depth for multiplication, and the threshold depth is found to decrease with increasing bias voltage. However, the effect could also be due to the surface properties of the detector making the depth correlation fortuitous. An analysis in terms of a threshold depth indicates that the multiplication may be due to a hole rather than an electron effect. No multiplication was observed for alpha particles with the same electric fields. P-n diffused junction detectors operated at similar average electric field strengths did not show any multiplication effects. (auth)

27703 INCREASING THE LIGHT COLLECTION EFFICIENCY OF SCINTILLATION COUNTERS. C. M. Ankenbrandt and E. M. Lent (Univ. of California, Livermore). Rev. Sci. Instr., 34: 647-51(June 1963).

A systematic study was made of methods of increasing the light collection efficiency of scintillation counters. Various reflectors, surface treatment of the scintillator, relative geometries of scintillator and photodiode, and light pipes were tried, using plastic scintillator cubes, 3 and 6 in. on a side, and right circular cylinders, 3 in. in diameter by 3 in. in length and 6 in. in diameter by 6 in. in length. The maximum factors by which light output could be increased, relative to a polished scintillator, were about 2.8 for 6-in. scintillators and 3.3 for 3-in. scintillators without the use of light pipes, and 5.0 for a 3-in. scintillator with light pipe. The fraction of light trapped in a right circular cylinder by total internal reflection is derived as a function of index of refraction, as are the percentages of light coming out the ends and sides of a cylinder. (auth)

27704 COLOR SCHEME FOR SPATIAL RESOLUTION USING LIQUID SCINTILLATORS. J. H. Munsee and F. Reines (Case Inst. of Tech., Cleveland). Rev. Sci. Instr., 34: 652-7(June 1963).

A detector was devised which contains in different regions liquid scintillators of different spectral emission characteristics, thus enabling signals arising in those regions to be distinguished from each other. The spatial discrimination so achieved can be applied to problems of low level β^- counting in which it is desired to reduce the background due to gamma rays. A study was made of five liquid scintillators, four of which have emission maxima in the range 4310 to 4660 Å and one with its maximum at 3640 Å, and various optical filter-scintillation combinations were tested. The beta, gamma discrimination possibilities of the color scheme were examined in a preliminary manner using C^{14} as the β^- source and Cs^{137} as the source of gamma rays. (auth)

27705 SOME DEVELOPMENTS OF THE DISCHARGE CHAMBER. G. Charpak (CERN, Geneva) and L. Massonet. Rev. Sci. Instr., 34: 664-9(June 1963).

A discharge chamber was constructed with electrodes of transparent metallic mesh. By the addition of quenching agents, mainly I_2 vapor, to noble gases at atmospheric pressure, and the use of pulses of one or several microseconds duration, it is shown that a great number of discharges connecting the two electrodes can develop simultaneously, starting from the ionized path of a particle. Pulses in the microsecond range of 2 to 3 kv/cm are used, thus allowing the easy operation of large sensitive volumes. Tracks of good resolution are observed, with a variation of the luminosity as a function of the primary ionization. Repetition rates up to 10^4/sec are reached. Sparks following the trajectory of particles inclined at angles of 45° with respect to the electrodes are observed. (auth)

27706 MUSCLE-EQUIVALENT ENVIRONMENTAL RADIATION METER OF EXTREME SENSITIVITY. Jacob Kastner (Argonne National Lab., Ill.), John E. Rose, and Francis R. Shonka. Science, 140: 1100-1(June 7, 1963).

A 16.5 liter spherical ion chamber was constructed of conducting muscle-equivalent plastic and filled to 760 mm-Hg with a muscle-equivalent gas. The use of the chamber for measurements of natural environmental backgrounds was made quite feasible with the aid of the recently developed Shonka vibrating quartz fiber electrometer. This instrument is routinely operable at the extremely high sensitivity of better than 5000 divisions per volt. This system, therefore, has made possible reproducible measurements of absorbed dose-rates of fractions of a microrad per hour without any need for the usual corrections for wall-effect, stopping power, and so forth. (auth)

27707 THE DETERMINATION OF THE PHYSICAL PARAMETERS OF A γ-ABSORPTION DENSITOMETER. Vladeta Urošević and Milan Kurepa. Tehnika, 17: 217-20 (1962). (In Serbo-Croatian)

Factors that affect the sensitivity and velocity of response of an apparatus for fluid and pulp density measurements, based on the difference in γ absorption in media with different densities, are discussed. The factors are the energy of the radiation, thickness of the irradiated material, and the efficiency of the detector. They were determined experimentally for an apparatus continuously controlling the density of milk of lime in a sugar factory. With the chosen parameters, a change of γ-radiation intensity from Cs^{137} was 1.2% when the change in density was 1° Bé and the duration of measurement 40 sec. The signal to noise ratio was 2.5 : 1. (OID)

27708 THE SELECTIVE RADIATION DETECTION OF Cu K-α RADIATION WITH PROPORTIONAL COUNTERS AND SINGLE-CHANNEL DISCRIMINATORS. Wolfgang Petzold (Freie Universität, Berlin). Z. Angew Phys., 15: 401-6(May 1963). (In German)

The possibility was discussed for selective detection of Cu K-α radiation in characteristic copper radiation by means of a proportional counter in combination with a single-channel pulse-height analyzer. The energy resolution possibility of the counter forces Cu K-β radiation to be excluded from detection by a nickel filter. The radiation source and detector are described. The separation of the radiation constituents and the count loss are discussed. (M.C.G.)

27709 THE TIME-RESOLUTION POSSIBILITIES OF PROPORTIONAL COUNTERS FOR THE MEASUREMENT OF SOFT X RAYS. Gerd Wolf (Max-Planck-Institut für Physik und Astrophysik, Munich). Z. Angew Phys., 15: 435-8(May 1963). (In German)

The discharge mechanism in a flowing gas (argon–methane) proportional counter for the absorption of soft x rays was investigated quantitatively. From that the attainable time resolution probabilities were deducted. The disturbing influence of ion signals on previous results was considered. As long as this can be neglected, the possibility for the time resolution of absorbed x rays at 10 kev lies under 10^{-7} sec. (tr-auth)

27710 RADIATION DOSIMETER READER. Richard Just (to Specialty Engineering and Electronics Co.). U. S. Patent 3,093,734. June 11, 1963. Filed Sept. 22, 1958.

A compact, efficient, battery-operated dosimeter reader that measures the total radiation dosage received by a silver-activated phosphate-glass detector by comparing the luminescence of the exposed detector under UV light to that of a detector exposed to a known radiation level is described. An arrangement for inserting the detector into the reader and positioning it in proper relation to the UV source and light pickup is featured. (D.C.W.)

27711 NUCLEAR RADIATION DETECTOR HAVING ELECTROSTATICALLY CHARGEABLE ELEMENTS. Walter Shriner. U. S. Patent 3,093,737. June 11, 1963. Filed Oct. 21, 1960.

An ionizing radiation detector that is inexpensive and requires no outside source of electric current for recharging is described. The device is activated by shaking that develops electric charge of opposite polarities on the walls of an ionization chamber and on free-floating elements within the chamber. Ionizing radiation causes a proportional decrease of the electrostatic charge, thereby letting some of the elements leave the walls. (D.C.W.)

ISOTOPE SEPARATION

Refer also to abstract 28582.

27712 (K-1571) THE VARIABLE KEY WEIGHT CASCADE FOR MULTICOMPONENT ISOTOPE SEPARATION. A. de la Garza (Oak Ridge Gaseous Diffusion Plant, Tenn.). July 1, 1963. Contract W-7405-eng-26. 18p.

A generalization of the previously reported matched abundance ratio cascades and constant key weight cascades is presented. It is shown how cascades may be formed in such a manner that the key weight is a function of stage number. Application of the result to optimization of a cascade design is discussed very briefly. (auth)

27713 (TID-8539) CALCULATING U-235 OUTPUTS AND CHARGES. William H. McVey, Edwin H. Davidson, and Gerald E. McTigue (Division of Operations Analysis and Forecasting, AEC). [1963]. 42p.

A report entitled "Methods of Calculating U^{235} Outputs and Charges by Use of Ideal Cascade Theory," TID-8522, was extended and updated. The topics covered are single product, multiple products, incremental productivity, cost per unit of contained U^{235}, cost of U^{235} consumption, minimum cost of products, blending uranium of different assays, and current AEC schedule of charges for enriched and depleted uranium. (M.C.G.)

27714 (UCOL-P-516) THE COLUTRON—A ZERO DEFLECTION ISOTOPE SEPARATOR. L. Wahlin (Colorado. Univ., Boulder). [nd]. Contract AT(11-1)-535. 14p.

On the isotope separator described, the conventional sector magnet was replaced by a velocity filter. This reduces the size and weight of the analyzing system by at least a factor of 50. Other features are: shorter beam path and adjustable mass dispersion. The isotope separator is designed to be a portable unit in a nuclear physics laboratory. It has a maximum dispersion equivalent to a 90° sector system with 210 cm radius and extended image plane. (auth)

27715 (AEC-tr-5855) CASCADE APPARATUS TO SEPARATE BORON ISOTOPES BY CHEMICAL EXCHANGE USING THE THERMAL PHASE-ROTATION METHOD. A. V. Makarov and G. M. Panchenkov. Translated by A. L. Monks (Oak Ridge National Lab., Tenn.) from Vestn. Mosk. Univ., [Ser. II, Khim.], No. 2, 58-60(1963). 4p.

In isotope separation single separation coefficients usually are close to unity. Thus, to obtain a highly concentrated product, "cascade" apparatuses, consisting of a number of cascades, must be constructed. Description is given of a two-stage cascade apparatus consisting of six capped columns, which was used in the chemical exchange separation of boron isotopes. The boron isotopes were fractionated between gaseous boron trifluoride and its liquid anisole complex. The cascade may be used for other BF_3 complexes and in the chemical exchange separation of isotopes of other elements using the thermal phase rotation method. (P.C.H.)

27716 THE ELECTROLYTIC SEPARATION FACTOR OF HYDROGEN ISOTOPES ON A PLATINUM CATHODE. Takeo Hisano (Tokushima Univ., Japan), Toshio Terazawa, and Kozo Hirota. Shokubai (Tokyo), 3: No. 2, 113-15(1961). (In Japanese)

Experimental study on the hydrogen isotope sep[illegible] factor (S. F.) of electrolytic hydrogen evolution react[illegible]n the platinum cathode was conducted in a wide range of [illegible] drogen overpotentials up to −40 v. The electrolyte used was a 0.05M aqueous solution of Na_2CO_3 containing 46% D_2O. The mass spectrometric technique was used for the determination of hydrogen isotope content in the gas sample taken from the cathode compartment of electrolytic cell. A markedly different behavior of the S. F. value as a function of the overpotential was observed, depending on the magnitude of overpotential: a very rapid increase of S. F. with increase of overpotential in the overpotential region below −0.14 v, a slow increase of S. F. in the region from −0.14 v to −1.0 v, and slow decrease of S. F. in the region over −1.0 v were observed. The minimum and maximum S. F. values 3 and 5.7 were obtained at the equilibrium potential and the overpotential of −1.0 v, respectively. (TTT)

27717 OVERVOLTAGE DEPENDENCE OF DEUTERIUM SEPARATION FACTOR ON PLATINUM. Juro Horiuti and Michiko Fukuda (Hokkaido Univ., Sapporo). Shokubai (Tokyo), 3: No. 2, 115-17(1961). (In Japanese)

An experimental technique for determination of electrolytic deuterium separation factor (S. F.) and the results obtained in 1N sulfuric acid, containing 10% D are reported. A gas sample was collected from the platinum cathode in a specially designed glass apparatus, and its deuterium content was analyzed by using both of the mass spectrometer and the Farkas gauze. Under the experimental conditions of a hydrogen saturation pressure ranging from 4 to 72 mm of Hg and a hydrogen overpotential from 0 to 0.4 volt, it was found that the S. F. values ranged from 2 to 5, but their reproducibility was in general very poor. (TTT)

27718 IMPROVEMENTS IN METHODS FOR ENRICHING AMMONIA IN DEUTERIUM. Bertrand Lazard and Jean-Marie Lerat (to Commissariat a l'Energie Atomique). British Patent 928,227. June 12, 1963. Priority date Aug. 22, 1958, France.

A method for deuterium enrichment of ammonia by means of a dual temperature exchange is presented. Liquid ammonia mixed with an alkali metal amide catalyst is contacted in counter-flow with gaseous hydrogen. The contact is made in stages in high and low-temperature reactors into which the ammonia and hydrogen are introduced in the inverse order. Deuterium-enriched ammonia is continuously removed from the high-temperature reactor and condensed while deuterium-impoverished hydrogen is removed from the low-temperature reactor. (C.E.S.)

27719 IMPROVEMENTS IN OR RELATING TO DEUTERIUM ISOTOPE EXCHANGE. (to Office National Industriel de l'Azote). British Patent 929,653. June 26, 1963. Priority date July 25, 1959, France.

A catalyst is described which is suitable for use in deuterium isotope exchange between H_2O vapor and H_2 at high temperatures and pressures (300 to 900°C and 1 to 100 kg/cm^2). The catalyst comprises Ni, Cr, or Pt or their compounds, and a refractory support with a balanced porosity of less than 15%, and it does not undergo mechanical disintegration under extreme temperature and pressure conditions. (D.L.C.)

MATHEMATICS AND COMPUTERS

27720 (HW-SA-2756) COMPUTER PROGRAMS FOR INDEXING X-RAY DIFFRACTION POWDER PATTERNS. I. THE CUBIC CASE. Jack B. Goebel and Archie S. Wilson (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). [Sept. 17, 1962]. Contract AT(45-1)-1350. 9p.

The set of Bragg angles as measured by an x-ray diffractometer from powdered crystalline samples is indexed on the basis of a cubic system by a computer program which was devised for the IBM 7090 computer. The lattice constant is determined by the method of least squares and is printed along with the observed and calculated reflections, their differences, the sum of the squares of the Miller indices, and an error term. The magnitude of the error term determines the validity of the cubic indexing. (auth)

27721 (KAPL-M-JA-6) KARE INPUT. Revision V. J. A. Archibald, Jr., and J. L. Fletcher (Knolls Atomic Power Lab., Schenectady, N. Y.). May 1, 1963. Contract W-31-109-eng-52. 54p.

Capabilities, requirements, specifications, boundary input, increment input, region dependent input, and general input for the revised KARE program are discussed. (D.C.W.)

27722 (NYO-10426) SOME IMPLICIT FINITE DIFFERENCE SCHEMES FOR HYPERBOLIC SYSTEMS. John Gary (New York Univ., New York. Courant Inst. of Mathematical Sciences). Mar. 1, 1963. Contract AT(30-1)-1480. 19p.

Implicit finite difference schemes using large time steps can be an advantage in computing slowly varying solutions to hyperbolic systems, but the usual Crank-Nicholson scheme as applied to a hyperbolic system is rather slow. Two modifications of the Crank-Nicholson scheme for hyperbolic systems that are implicit only in that they require the inversion of tridiagonal matrices are described. However, these schemes are unconditionally stable only for positive definite systems (supersonic flow). The results of computations using these schemes are described. (auth)

27723 (ORNL-3447) A CDC-1604 SUBROUTINE PACKAGE FOR MAKING LINEAR, LOGARITHMIC AND SEMILOGARITHMIC GRAPHS USING THE CALCOMP PLOTTER. D. K. Trubey and M. B. Emmett (Oak Ridge National Lab., Tenn.). June 24, 1963. Contract W-7405-eng-26. 16p.

A CDC-1604 subroutine package was written to facilitate the plotting of curves and points on linear, logarithmic, and semilogarithmic graphs using the CALCOMP plotter. The subroutines accomplish the necessary computations and prepare a magnetic tape for use by the plotter. (auth)

27724 (TID-18886) DESCRIPTORS FOR A TWO-PHASE AUTOMATIC DATA RETRIEVAL SYSTEM FOR DIGITAL CIRCUIT MODULES. C. F. Chao, R. C. Dorf, C. T. Hu, and A. H. Koschmann (New Mexico. Univ., Albuquerque. Engineering Experiment Station). Nov. 1958. For Sandia Corp., Albuquerque, N. Mex. Contract [AT(29-1)-789]. 78p. (SCDC-3251; UNM-TR-EE-20)

A list of descriptors to be used in a simplified retrieval system for transistorized pulse circuit modules is presented. The particular values of these descriptors are given for a number of existing modules. A more detailed analysis of these circuits is also included. (auth)

27725 (WAPD-T-1591) USE OF FORTRAN IN LARGE PROGRAMS. O. J. Marlowe (Westinghouse Electric Corp. Bettis Atomic Power Lab., Pittsburgh). Mar. 1963. Contract AT-11-1-GEN-14. 6p.

To make it possible to use the FORTRAN language for many large programs that require extensive use of auxiliary storage and must be executed in a highly axiomated computer operation, it was necessary to extend and modify the language in the areas of storage allocation including the use of auxiliary storage, input data format and processing, and operating system requirements. These additions and modifications are represented by three subroutine packages called FTB, INPF, and FBKS, respectively. The motivation for the use of FORTRAN in general and the specification of these subroutines in particular will be given as well as a detailed description of FTB. (auth)

27726 ELEMENTY CHISLENNOGO ANALIZA I MATEMATICHESKOI OBRABOTKI REZUL'TATOV OPYTA. (Elements of Numerical Analysis and Mathematical Processing of Experimental Results). R. S. Guter and B. V. Ovchinskii. Moscow, State Printing House of Physics and Mathematical Literature, 1962. 355p.

Basic methods of approach for the calculation, interpolation, and solution of differential equations are investigated. Methods of probability theory and its application to the theory of error control and interpolation of minimum quadratic processes in selected empirical formulas are presented. The material presented is accompanied by a large number of calculated examples and processing results. The methods are applied to various systems including Newton's equations, Lagrange's equations, Bessel functions, Euler's equations, Laplace's equation, Bernoulli's principle, and Gauss' equations. (C.E.S.)

METALS, CERAMICS, AND OTHER MATERIALS

General and Miscellaneous

Refer also to abstracts 27535 and 27967.

27727 (ASD-TDR-63-322) SYNTHESIS AND PYROLYSIS OF METAL ALKOXIDES AS POTENTIAL REFRACTORY OXIDE COATINGS FOR GRAPHITE. K. S. Mazdiyasni and C. T. Lynch (Aeronautical Systems Div., Wright-Patterson AFB, Ohio). Apr. 1963. 40p.

The vapor-phase deposition of hafnia and zirconia on graphite substrates by decomposition of the isopropyl and tertiary butyl alkoxides was investigated. The infrared spectra of the isopropoxides of zirconium and hafnium were obtained. Thorium isopropoxide infrared data were also obtained and the spectra compared with titanium and aluminum isopropoxides. The tertiary butoxides show more promise for coating applications because of their higher vapor pressures. The vapor pressures and decomposition temperatures of the zirconium and hafnium butoxides were studied. Preliminary data on the oxidation resistance to 1000°C of various grades of graphite coated by this method are reported. The results indicate a potential route to more protective refractory coatings than currently available. (auth)

27728 (GEAP-4076) SPECIFIC ZIRCONIUM ALLOY DESIGN PROGRAM. Second Quarterly Progress Report, July–September 1962. H. H. Kelpfer, K. C. Antony, W. B. Nelson, D. L. Douglass, and J. S. Armijo (General Electric Co. Vallecitos Atomic Lab., San Jose, Calif.). Oct. 9, 1962. Contract AT(04-3)-189. 64p. (EURAEC-488)

A program is in progress for the design of a zirconium-base alloy for application as nuclear fuel cladding for steam service. Specifications were derived for an acceptable alloy for such service, based on considerations of neutron economy, cost, hydrogen embrittlement, corrosion resistance, fabricability, and strength. The selection of the field of alloy compositions having promise for meeting these specifications was made. Thirty-one alloys were arc-melted, fabricated to sheet, and heat treated. Over 1800 test coupons were prepared from the heat-treated alloy sheet. The coupons are being tested to determine response to alloy composition. The response parameters will measure: corrosion resistance at 300, 400, and 500°C; mechanical properties before and after corrosion exposure; and hydrogen pick-up during corrosion. The experiment is designed to permit analysis of the results employing computer programming to determine the optimum composition. Fundamental studies in support of the alloy design are in progress. Program work on the hydrogen overvoltage for zirconium intermetallic compounds is essentially complete. Selected alloy corrosion films were prepared for microprobe analyses in a study of partitioning of alloy elements between corrosion film and substrate. Optical microscopy of the corrosion films was completed. Solid solution alloys were fabricated and corroded for a comparison of partitioning of soluble versus insoluble additions. Four doped zirconium dioxide samples for oxygen diffusion and mechanical property studies were hot-pressed and partially characterized. (auth)

27729 (HW-76636) NEUTRON IRRADIATION AND COLD WORK EFFECTS ON ZIRCALOY-2 CORROSION AND HYDROGEN PICKUP. An Interim Report. W. A. Burns and H. P. Maffei (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Dec. 1962. Contract AT(45-1)-1350. 30p.

Corrosion weight gains and hydrogen sorption for Zircaloy-2 specimens exposed to similar aqueous and thermal environments in- and out-of-reactor were compared to obtain quantitative information relative to the effects of a high-energy neutron flux on the processes involved. Metal specimens representing four levels of cold work were exposed in high quality water at 540°F to fast-neutron flux intensities over the range 1.7 to 4.2×10^{13} nv (>1.0 Mev) and to a maximum integrated fast flux of 1.06×10^{20} nvt. In-reactor weight gains were found to be higher by an order of magnitude, and a saturation effect of flux was indicated. No significant effects of work history on corrosion were observed. Fractional pickup of corrosion hydrogen in-reactor was within the range normally expected for out-of-reactor exposure, but a trend toward reduced pickup of hydrogen by material cold worked to the extent of about 10% was observed. No effect of cold work on hydrogen pickup was observed for unirradiated specimens. (auth)

27730 (HW-77052) METALLURGY RESEARCH OPERATION QUARTERLY PROGRESS REPORT, JANUARY–MARCH 1963. (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Apr. 15, 1963. Contract AT(45-1)-1350. 250p.

Research and development progress is reported on neutron damage to metals, swelling of irradiated fissionable materials, plutonium physical metallurgy, alloy selection for reactor metals research, in-reactor measurements of mechanical properties, irradiation effects, flux monitoring studies, damage mechanisms, environmental effects, materials development for Plutonium Recycle Test Reactor, aluminum corrosion and alloy development, production reactor corrosion and coating studies, N-reactor corrosion and hydriding studies, radiation damage to reactor components, gas-loop development, PRTR pressure tubes, and N-Reactor pressure tubes. (M.C.G.)

27731 (NASA-TM-X-884) NOTES ON LIQUID METAL STUDIES IN FRANCE AND GREAT BRITAIN. Leo F. Epstein (General Electric Co. Vellecitos Atomic Lab., Pleasanton, Calif.). June 1963. For National Aeronautics and Space Administration, Washington, D. C. Contract NASr-108. 17p.

Observations made in laboratories engaged in liquid metal work in Great Britain and France are summarized. Studies are being pursued with a high degree of competence. Many of the problems are identical with those in U.S. research. (auth)

27732 (NLCO-881) ELECTRON BEAM MELTING OF URANIUM. H. M. Eikenberry (National Lead Co. of Ohio, Cincinnati). June 14, 1963. Contract AT(30-1)-1156. 27p.

Feed stock prepared from ingot, dingot, and under-salt-melted U was melted by electron bombardment. Analysis of the ingots produced revealed that some Al, Cr, Mg, Mn, and Pb were volatilized from the melt. C was reduced when Zr was present in the feed material. H_2 and N_2 also were removed, the latter only when there was a relatively high concentration in the feed material. The work indicated the need for very slow melting rates or the casting of large diameter ingots for successful refinement of U. (auth)

27733 (NMI-2116) FUNDAMENTAL AND APPLIED RESEARCH AND DEVELOPMENT IN METALLURGY. Progress Report to United States Atomic Energy Commission, March 1963. (Nuclear Metals, Inc., Concord, Mass.). May 28, 1963. Contract AT(30-1)-2784. 27p.

Zone-refining of a silicon-doped crystal was completed. Resistance ratios were measured on specimens from a 12-pass zone-refined crystal. A rather large drop in resistance ratio (1300 to 750) was observed near the start end of the crystal. A tensile test was performed on a sample from this crystal oriented for basal slip. The results show that additional zone-refining passes did not lower the CRSS for basal slip. Three compression test samples were machined from 6- and 7-pass crystals of intermediate purity levels, and resistance ratio data were obtained on them. An attempt was made to establish rolling temperatures for Nb–Re alloys, and tensile test specimens of the rolled alloy were prepared. An attempt was also made to develop cold-rolling schedules for Ta–Ru alloys. The tensile properties of Ta, Ta–Ru, Ta–W–Zr, Ta–W, and Ta–W–Hf were investigated. The effects of aging and warm working on the properties of U–1.2 wt % Cu SLIS alloy were investigated by hot-hardness and metallographic techniques. Warm working raised the hardness level at temperatures up to 4000°C, but produced no beneficial effects at higher temperatures. The 600° aging treatment had less effect than warm working, actually lowering the 300 and 400°C hardness slightly. Development of etching techniques for U–Cu alloys was begun. Development of fabrication techniques for seamless high quality tubing of W and W–Re alloys (0.375-in. diameter and 0.030-in. wall) was continued. Tubing was extruded using Fe and Mo outer cans and Mo cores containing graphite cores. Tubing was also produced by extrusion at 1200°C, annealing at 1450°C, and subsequent drawing. Hardness tests showed that the annealing at 1450° caused a definite softening of the material. W extruded at 1200°C could be bent to a 90° angle at 370 and 535°C, while a specimen annealed at 1450°C was bent at 230°C with fracture occurring only near 90°. Metallographic examination showed that annealing for one hour at 1000°C produced very little effect, while at 1200°C some grain growth was observed. Annealing at 1400 and 1480°C produced considerable recrystallization. (D.C.W.)

27734 (TID-7666) MINUTES OF CERAMIC FUELS MEETING HELD IN BRUSSELS, OCTOBER 3–5, 1962. (United States–Euratom Joint Research and Development Program). 61p. (EUR/C/4936/62e)

An account is given of the papers and discussions which were presented at the meeting. The topics discussed were: fabrication of UO_2; properties of UO_2; irradiation behavior of UO_2; and a brief review of UC, UN, and other ceramic fuels. (D.L.C.)

27735 (AEC-tr-5838) CHARACTERISTICS OF "VITREOUS CARBON." Keihiko Yamada and Hiroshi Sato. Translated from Kogyo Kagaku Zasshi, 65: 1139-40(1962). 4p.

A new and different process was invented for the production of impermeable graphite, called Vitreous Carbon because, in external appearance and cross section, it has characteristics similar to those of common glass. Neither mold forming nor forming by centrifugal separation of cellulose carbon is used. The invention is advantageous in that a variety of various shapes may be formed easily by means of a unique process that is quite different from other well-known methods for the production of graphite. Properties and photomicrographs of Vitreous Carbon are compared with common and high density graphite. (P.C.H.)

27736 ON SILICIDES OF SCANDIUM AND GADOLINIUM. G. V. Samsonov, Yu. B. Paderno, and T. S. Verkhoglyadova. Dopovidi Akad. Nauk Ukr. RSR, No. 2, 224-6 (1963). (In Ukrainian)

The conditions for formation of silicides of scandium and gadolinium were investigated. It was found that scandium forms monosilicide ScSi, which is close to yttrium silicide in respect to crystal structure, and Sc_3Si_5; the typical silicide of gadolinium is $GdSi_2$, possessing a certain region of homogeneity and melting at 2100°. The peculiarities of the electron structure of the silicide phases of scandium and gadolinium are discussed. (auth)

27737 URANIUM OXIDE (UO_2). Paul Fernet de Boisdeffre. Euratom Bull., No. 1, 14-21(1963). (In English)

A review is presented on the fabrication and advantages of UO_2 as a fuel element and its in-pile behavior. (P.C.H.)

27738 PLUTONIUM, A SYNTHETIC SOURCE OF ENERGY. Emile Vanden Bemden. Euratom Bull., No. 1, 22-9(1963). (In English)

A review is presented on the production and use of plutonium, problems involved in the processing of plutonium compounds, types of plutonium-enriched fuel used in nuclear reactors, and fabrication of plutonium-enriched nuclear fuels. (P.C.H.)

27739 PREPARATION OF TECHNETIUM METAL. J. D. Eakins and D. G. Humphries (Atomic Energy Research Establishment, Harwell, Berks, Eng.). J. Inorg. Nucl. Chem., 25: 737(June 1963).

Technetium metal was prepared in bulk by electrodeposition and also by decomposition of ammonium hexachlorotechnetate. (C.E.S.)

27740 ON A CASE OF SOLARIZATION DURING STEAM SINTERING OF UO_2 PELLETS. I. Amato, R. L. Colombo, and A. M. Protti (FIAT, Turin). J. Nucl. Mater., 8: 271-2(Mar.-Apr. 1963). (In English)

Solarization of UO_2 pellets was observed during steam sintering, when no evidence of solarization during hydrogen sintering had been found. Steam sintering of the powder was characterized by discontinuous grain growth from early states. It is shown that solarization is not due to some reverting of sintering. This indicates that the open porosity is less for a solarized specimen than for a non-solarized one having higher density. (P.C.H.)

27741 PURIFICATION OF RAW COKE FOR PRODUCTION OF HIGH-PURITY ARTIFICIAL GRAPHITE. Tadao Ishikawa and Shiro Yoshizawa (Kyoto Univ.). Kogyo Kagaku Zasshi, 66: 8-14(Jan. 1963).

An investigation of the purification of raw coke was carried out to obtain high purity artificial graphite in which the content of V was required to be below 10 ppm. The degree of purification of the coke was followed by the elimination of V as analyzed by the polarographic method. The 2 purification methods used for extraction were based on the formation of vanadate or vanadyl with alkali or acid and the sublimation of volatile vanadium-halogen compounds formed. The first extraction method was not successful, but the latter resulted in efficient purification of raw coke. As a source of halogen, it was found that NH_4Cl was best for industrial purposes, but NaCl or Cl_2 gave equally good results. The content of V of raw coke decreased from several hundreds to a few ppm by treatment under the conditions described, namely, the coke was impregnated with 5% NH_4Cl and heated at 2000°C for 3 hr. In other investigations on the behavior of impurities in raw coke, it was found that the heated coke had to be cooled in the atmos-

phere of inert gas flowing from inside to the outside of the furnace. (H.H.D.)

27742 PRODUCTION OF HIGH-PURITY ARTIFICIAL GRAPHITE. Tadao Ishikawa and Shiro Yoshizawa (Kyoto Univ.). Kogyo Kagaku Zasshi, 66: 14-18(Jan. 1963).

The most effective treatment to remove V from raw coke was to treat the coke with 5% of NH_4Cl and heat at 2000°C for 3 hr. A graphitization furnace was used to attain the temperature of 2000°C. Satisfactory results were also obtained by the same purification and graphitization process by adding the necessary amount of NH_4Cl or NaCl to the raw mixture. For molded graphite products, impregnation with saturated solutions of NH_4Cl or NaCl and treatment with Cl_2 during heating were tried. The methods were also applicable to the purification of graphite of low purity. The degree of graphitization of purified graphite was slightly higher than that of unpurified graphite. The elimination of B from graphite must be attained in order for it to meet the requirement for use in atomic reactors. It was shown that the treatment of graphite with Cl_2 containing HF mist at 2000°C for 3 hr is effective for the purpose of decreasing B content to less than 1 ppm. The formation of $(CF)_n$ must be avoided by use of the Cl_2-HF mixture at high temperature, because $(CF)_n$ is formed below 700°C. (H.H.D.)

27743 KRYPTON FLUORIDE: PREPARATION BY THE MATRIX ISOLATION TECHNIQUE. J. J. Turner and George C. Pimentel (Univ. of California, Berkeley). Science, 140: 974-5(May 31, 1963).

A method is described for the preparation of KrF_2 by the photolysis of fluorine suspended in a solid mixture of argon and krypton at 20°K. This experimental method is called the matrix isolation technique. (C.H.)

27744 XENON FLUORIDES: FLUORINE-19 NUCLEAR MAGNETIC RESONANCE SPECTRA. A. C. Rutenberg (Oak Ridge National Lab., Tenn.). Science, 140: 993-4 (May 31, 1963).

Chemical shifts were measured for liquid XeF_2, XeF_4, $XeOF_4$, and XeF_6, and $F^{19}-Xe^{129}$ spin-spin coupling constants for XeF_4 and $XeOF_4$. The data are in accord with reported structures and are similar to values in the literature for chemical shifts of fluorides of neighboring elements. (auth)

27745 IMPROVEMENTS IN AND RELATING TO THE CHEMICAL POLISHING OF BERYLLIUM. Alan Edward Bottom and Arthur Ince (to C. A. Parsons & Co. Ltd.). British Patent 928,454. June 12, 1963. Filed Dec. 3, 1958.

The oxidation resistance of Be that is to be used for canning nuclear fuels can be improved considerably by subjecting the metal to a solution of nitric acid, phosphoric acid, and water after which the metal is etched in hot 10% sulfuric acid and is then chemically polished in a solution of the previous composition. A high gloss finish is obtained. (D.C.W.)

Corrosion

Refer also to abstracts 27965 and 28528.

27746 (DPST-63-71-1) APPLICATION OF THE ELECTRON MICROPROBE TO THE STUDY OF ZIRCALOY CORROSION FILM. Quarterly Progress Report, January-March 1963. (Du Pont de Nemours (E. I.) & Co., Wilmington, Del.). May 1963. Contract AT(07-2)-1. 13p.

Analyses were made on the distribution of alloying elements, Ni, Nb, Cu, Fe, and Cr, in oxidized Zr in order to study the corrosion mechanisms of Zircaloy-2. Measurements were also made on the characteristic x-ray lines of Sn, Fe, Ni, and Cr in Zircaloy-2 using an electron beam. The results indicate that, for most elements, concentrations in the order of 100 ppm could be determined in an area of about 5 μ diameter; even lower concentrations could be measured in larger areas. (P.C.H.)

27747 (HW-74359(Rev.)) EROSION-CORROSION OF ALUMINUM ALLOYS. R. L. Dillon and R. S. Hope (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Apr. 1963. Contract AT(45-1)-1350. 32p.

A pattern of attack, qualitatively similar to groove pitting of irradiated fuel cladding, was produced in the laboratory. The relative susceptibility to attack of X-8001 alloy aluminum in comparison to 1245 alloy aluminum is in agreement with reactor experience. The remaining readily recognizable feature of in-reactor groove pitting is its confinement to the downstream pieces in the process tube. The laboratory analogy to this effect is found in the diminution of attack as the system pressure is increased at constant temperature, flow rate, and water quality. Tests showed that the laboratory simulated groove pitting involves both mechanical and chemical components. Under the conditions studied, both must be present before observable metal removal occurs. Of the mechanical factors studied, flow rate of the water was most important. At a given flow rate, temperature, and water quality, increase in pressure on the system tended to reduce the attack. The effect of water chemistry is demonstrated by the inability to simulate groove pitting, or in fact to remove metal, in deionized water; substantial attack can be produced in process waters. The laboratory tests were largely conducted with laboratory tap water rather than reactor process water, both as a matter of availability and as a device for accelerating the corrosion process. Significant inhibition of metal removal resulted from dichromate additions and reduced pH. (auth)

27748 (KAPL-2257) AQUEOUS CORROSION OF ZIRCONIUM SINGLE CRYSTALS. A. E. Bibb and J. R. Fascia (Knolls Atomic Power Lab., Schenectady, N. Y.). Oct. 1962. Contract W-31-109-eng-52. 20p.

Single-crystal wafers of Zr were exposed to 680°F neutral water. The single crystals were of known orientation, and weight-gain data were obtained as a function of crystal orientation. The data show that all the crystal faces studied obeyed a cubic rate law out to the time of transition; whereupon, the crystals corroded at an approximately linear rate. The time to transition varied from 114 days for $(10\bar{1}4)$ crystals to about 325 days for the $(21\bar{3}0)$ faces. The epitaxial relation between metal and monoclinic oxide was found to be (0001) // $(1\bar{1}1)$ and $[11\bar{2}0]$ // $[10\bar{1}]$. A black, tight, adherent oxide layer was formed on the crystals in the pretransition range. This black oxide was found to be monocrystalline. The white corrosion product produced after transition was found to be polycrystalline but highly oriented. X-ray line-broadening studies found that the black oxide was a highly strained structure; whereas, the white oxide was relatively strain free. The results indicate that a strain-induced recrystallization or fragmentation accompanies the change from protective black oxide to nonprotective white oxide. (auth)

27749 (KAPL-M-CC-3) CHLORIDE STRESS CORROSION CRACKING OF Ni-Cr-Fe ALLOYS. C. F. Cheng

and H. L. Tymchyn (Knolls Atomic Power Lab., Schenectady, N. Y.). Apr. 3, 1963. Contract W-31-109-eng-52. 42p.

Ni–Cr–Fe alloys were weld deposited in three layers on carbon steel and stress-relieved at 1150°F. Chemical analyses showed decreasing iron (33 to 8%) and increasing nickel (50 to 77%) and chromium (10 to 20%) in the successive layers away from the carbon steel base. The coupons were corrosion tested as stressed U-bends in a tilting autoclave, first for two 100-hr periods in initially aerated boiler water (500 ppm Cl) at 500 F, and then for two 360-hr periods in initially aerated sea water (17,000 ppm Cl) at 550°F. Neither these weld overlays nor wrought strips of Inconel Alloy 600, Inconel-X, Inconel-C, Zircaloy-2, or Zircaloy-4 exhibited any cracking. Stress-relieved austenitic stainless steel weld overlays (Made with type 309 in the first layer over carbon steel type 308 in the second and third layers) suffered chloride stress-corrosion cracking, as did type 304 stainless wrought annealed strips. Some of the first layer weld overlays of Ni–Cr–Fe alloys showed surface coring pits along the dendrites, but none of these initiated or propagated into stress-corrosion cracks. The susceptibility of Ni–Cr–Fe alloys to chloride stress corrosion is increased by adding molybdenum. In alloys without molybdenum, no cracking is noted below 2.539 Å mean atomic diameter. The critical mean atomic diameter decreases with increasing molybdenum content. The multibranched cracks are intergranular for wrought alloys and interdendritic for weld overlays. In austenitic stainless steels, wrought type 304 cracks transgranularly, and types 308 and 309 weld overlays show mixed cracks along and across the dendrites. Their mean atomic diameters range between 2.540 to 2.542 Å. Mean atomic diameter is measured by rapid, economical, non-destructive x-ray diffraction technique. (auth)

27750 (ORNL-3099) IN-PILE RADIATION CORROSION EXPERIMENTS WITH ZIRCONIUM, TITANIUM, AND STEEL ALLOYS IN 0.17 m UO_2SO_4 SOLUTIONS AT 280°C. G. H. Jenks and J. E. Baker (Oak Ridge National Lab., Tenn.). July 10, 1963. Contract W-7405-eng-26. 71p.

In-pile loop experiments L-2-15 and L-4-16 were designed to test the radiation corrosion of Zircaloy-2 and other possible reactor construction materials in UO_2SO_4 solutions. The solutions employed were 0.17 m UO_2SO_4, 0.015 m $CuSO_4$, and 0.03 m H_2SO_4 in H_2O for experiment L-2-15, and 0.17 m UO_2SO_4, 0.015 m $CuSO_4$, and 0.025 m H_2SO_4 in H_2O for experiment L-4-16. The mainstream temperature in the experiments ranged from 278 to 280°C. Construction material for the loops was type 347 stainless steel. Specimens of types 347 and 309SCb stainless steels titanium-55A and -110AT, platinum, Zircaloy-2, crystal-bar zirconium, and a variety of other zirconium alloys were tested. The power density at core specimens ranged from 19.8 to 4.6 w/ml in L-2-15 and from 5.7 to 1.3 w/ml in L-4-16. For loop L-2-15, the total time of high-temperature operation with UO_2SO_4 was 792 hr, during in-pile exposure, and the reactor energy was 1632 Mwh; for loop L-4-16, 1032 hr and 2325 Mwh. During both experiments most of the reactor energy was accumulated at 3-Mw power level. In general, stainless steel corrosion results from these experiments were comparable to those observed in other in-pile loop experiments. Corrosion was confined primarily to the core areas and was power-density dependent. Some variations in attack, both positive and negative, with velocity of solution flow past specimens have been observed in other experiments, but there was no apparent effect of varying velocities in the range 10 to 40 fps on either the core-channel or in-line channel specimens in the present experiments. The core-annulus steel specimens in L-2-15 corroded at rates very much greater than those in the channel. This difference may have resulted, in part, from the differences in velocities; however, it may have also been a result of galvanic action between the steel annulus specimens and adjacent platinum specimens. In previous 250°C experiments the occurrence of a change in the stainless steel corrosion rate was correlated with a decrease in acidity and/or increase in the nickel concentration. The results for the oxygen consumption rates on steel during radiation exposure in the present experiments varied with radiation time in a manner qualitatively similar to that observed at the lower temperature. However, the concentration of excess acid in the present experiments probably remained fairly constant throughout the radiation exposures, and correlations similar to those obtained at the lower temperature could not be established. The acid concentration in the 280°C experiments was greater than the concentrations prevailing when corrosion rate changes occurred in the 250°C experiments. The difference in acid tolerance is probably a result of the increased temperature, since a similar beneficial effect of temperature occurs out-of-pile. No overall correlation has been established for the various factors found to have influenced steel corrosion in previous experiments. Results of the present experiments provide additional evidence in support of previous findings but do not further their interpretation. Zircaloy-2 corrosion results from both loops have been discussed and correlated elsewhere in terms of the 280°C relationship between the corrosion rate R (mils per year, mpy), power density P (w/ml), and uranium sorption factor α: $1/R = 2.23/P\alpha + 1/40$. The data from these experiments obey this relationship. The values of α for core-annulus specimens exposed to velocities of about 0.8 fps in both experiments were 3.3 for L-2-15 and about 2.6 for L-4-16. For the exposed surfaces in the channel specimens from L-2-15 and for those channel specimens located in the convergent section of the channel in L-4-16, α is estimated at about 1. Specimens located in the divergent section of the channel in L-4-16 exhibited higher α values. Core-annulus coupons of zirconium alloyed with niobium, palladium, or platinum from experiment L-4-16 exhibited corrosion rates varying from 40 to 90% of the rates observed for core-annulus coupons of Zircaloy-2 at similar power densities when the specimen materials were heat-treated at 900°C for 3 hr and then water-quenched. Other specimens of the same alloys subjected to the same heat treatment and to additional treatment at 600°C for 48 hr and then air-cooled exhibited rates varying from 80 to 230% of those observed for the Zircaloy-2 core-annulus coupons. Two core-annulus impact specimens of Zr–15% Nb subjected to these heat treatments and a third impact specimen of Zircaloy-2 heat-treated at 650°C for 30 min exhibited rates from 130 to 140% of those observed for the Zircaloy-2 core-annulus coupons. Two Zircaloy-2 coupons clad with nickel and then platinum and exposed in the core annulus of experiment L-2-15 and two similar coupons from the line-annulus position exhibited very high weight losses as a result of the loss of nickel layer. Platinum specimens from L-2-15 exhibited negligible corrosion rates. Results for Ti-55A specimens indicate that in-pile titanium corrosion was affected to a greater extent by some uniform change in the solution under radiation than by fission recoil irradiation of specimen surfaces or by the fissioning which takes place in the solution immediately adjacent to specimens. The average corrosion rate (based on radia-

tion time and total area) for the core-channel coupons from experiment L-4-16 was 0.22 mpy, and 0.20 mpy for the in-line channel coupons. The average rate for the core-channel coupons in experiment L-2-15 was 1.2 mpy. In-line channel coupons from this experiment exhibited an average weight increase of 1.1 mg/cm^2. However, at the generally low rates prevailing for titanium, it is likely that the in-line results were affected appreciably by retained scale. Impact, tensile, and stress specimens of Ti-110AT in the core-annulus regions of both experiments exhibited higher rates than core-annulus coupons of Ti-55A. Analyses of bulk scale from various parts of loop L-4-16 show wide variations in composition and are considered only qualitative. The results indicate that nearly all the zirconium that was oxidized in the core was transported to portions of the loop outside the core and deposited in the scale. The analyses also indicate that appreciable amounts of nickel are incorporated in the loop scales. Also, in these and other experiments, the difference between amounts of steel corrosion indicated by oxygen and dissolved-nickel data reveals that nickel is retained in the scales and, consequently, that the amount of dissolved nickel cannot be used as an accurate measure of steel corrosion in these systems. There was no evidence of solution instability in these experiments. Some fluctuations in analytical results were ascribed to sampling and analytical errors. (auth)

27751 (WAPD-T-1567) EFFECTS OF SILICON, NITROGEN, AND OXYGEN ON THE CORROSION AND HYDROGEN ABSORPTION PERFORMANCE OF ZIRCALOY-2. S. Kass, J. D. Grozier, and F. L. Shubert (Westinghouse Electric Corp. Bettis Atomic Power Lab., Pittsburgh). Jan. 1963. Contract AT-11-1-GEN-14. 69p.

The corrosion properties of Zircaloy-2 are altered by small quantities of silicon or nitrogen. Increasing nitrogen contents are noted to produce increased total corrosion and decreased time for transition in the weight gain-time kinetics. Silicon additions tend to produce higher weight gain values but at the same time, render the alloy less susceptible to hydrogen absorption during aqueous corrosion exposure. The silicon additions minimize the deleterious effects upon corrosion resistance that occur due to slowly cooling the alloy through or hot working in the alpha plus beta region. A marked dependence of the hydrogen absorption by Zircaloy-2 upon prior thermal treatment is observed. (N.W.R.)

27752 RESISTANCE OF SYNTHETIC PAINTS TO IRRADIATION. Charles Duvivier (Societe des Revetements Nucleaires et Marins, Paris-Neuilly). Ind. At., 7: No. 3-4, 93-7(1963). (In French)

Protection of surfaces against chemical and nuclear corrosion by the use of synthetic paints is a complex problem involving not only the chemical and physical stability of the substance, but also its radiation stability. The factors contributing to the complexity of the problem are reviewed briefly, and the comparative tests necessary to evaluate properly the stability of a given synthetic paint are indicated. (J.S.R.)

27753 THE USE OF α-SPECTROSCOPY FOR STUDYING ANODIC OXIDATION. J. A. Davies and B. Domeij (Nobel Inst. of Physics and Royal Inst. of Tech., Stockholm). J. Electrochem. Soc., 110: 849-52(July 1963).

Experiments are described in which α spectroscopy was used to study the anodic oxidation of Al and Ta under those conditions in which, from previous Xe^{125} work, a significant burying is known to occur. A beam of Rn^{222} ions accelerated to 2 to 6 kev energy was injected into the flat face of an Al or Ta target by means of an electromagnetic isotope separator. After measuring the energy spectrum of the 5.486-Mev α particles, the targets were anodized at constant current to 200 v, using a 3% solution of dibasic ammonium citrate in water as electrolyte, and the energy spectrum of the particles was remeasured. Although the shape of the α spectrum remained virtually unchanged, the position of the peak in each case was shifted to a considerably lower energy, indicating that the Rn^{222} atoms were deeply buried in the oxide layer. The Rn^{222} atoms retained a sharp distribution in the growing oxide film, as was expected of inert tracers. (M.C.G.)

27754 ON THE OXIDATION OF THIN FILMS OF ZIRCONIUM. J. E. Bailey (Central Electricity Generating Board, Berkeley, Glos., Engl). J. Nucl. Mater., 8: 259-62 (Mar.-Apr. 1963). (In English)

Investigations were made on oxide films on thin films of Zr by the transmission electron microscopy technique. Thin films of crystal bar Zr (~1000 Å thick) were prepared by electropolishing and then annealed for 1 hr at either 350 or 500°C in commercial oxygen. Electron diffraction patterns showed that the oxide on some areas of the metal was highly oriented. Thin films of Zr inside the electron microscope were observed to oxidize at an appreciable rate in the low pressure atmosphere; for example, films heated to 450°C were observed to oxidize uniformly although the rate varied from one grain to another. After a period of several minutes, needle-like precipitates were observed in the Zr matrix predominantly near the edge of the film. However, evidence was found to exclude the possibility of twins. Heating films to higher temperatures (~700°C) resulted in the formation of much larger precipitates, which often extended many microns in from the edge of the foil. It was concluded that the precipitates result from the absorption of oxygen and subsequent precipitation of an oxide. (P.C.H.)

27755 INSTITUTE OF METALLURGY, METALLOGRAPHY, AND SPECIAL CHEMICAL TECHNIQUES, UNIVERSITY OF ROME: ACTIVITIES DURING 1960-62. Felice de Carli (Università, Rome). Notiz. Ric. Sci., (2), 3: 137-52(Feb. 1963). (In Italian)

An outline of research carried out is presented. It included problems of corrosion (behavior of carbon steels in contact with pure molten Bi, with or without inhibitors, or with molten Li), the physical chemistry of metals showing defective metallic surfaces of single and bicrystals and of metallic oxide crystals, and metallography (behavior of various materials subjected to thermal cycling). Apparatus designed and constructed for annealing experiments in a magnetic field on transformer stampings is also described. (P.C.H.)

27756 HIGH-TEMPERATURE CIRCUIT FOR TESTING THE STABILITY AND CORROSION RESISTANCE OF CONSTRUCTION MATERIALS IN LIQUID SODIUM. V. I. Nikitin. Teploenerg., No. 5, 80-3(May 1963). (In Russian)

The design is given of a laboratory circuit for determining corrosion resistance and stability of construction materials in sodium at 1000°C. Short-duration tests were made of nickel base and chromium-nickel austenitic steels at 1000°C. (R.V.J.)

Fabrication

Refer also to abstracts 28471, 28472, 28473, and 28531.

27757 (EUR-273.f) AMELIORATION DE LA TECHNOLOGIE DU FRITTOXAL EN VUE DES APPLICATIONS

NUCLEAIRES PROPRIETES DES MATERIAUX ETUDIES. (Improvement in FRITTOXAL Technology with a View to Nuclear Applications — Properties of the Materials Studies). J. Boghen, P. Jehenson, M. Scheidecker, and J. Herenguel (Tréfileries et Laminoirs du Havre, France). 1963. 23p.

Some improvements of the semi-finished products quality by a special degassing thermal treatment on FRITTOXAL (then named FRITTOXAL B) are a decrease of the residual gas content and consequently, better high temperature (600°C) stability and welding properties. Some important characteristics of 120-20 B and 50-10 B preselectionned for the fabrication of fuel element tubes are: mechanical properties, creep, and hot stability; and also these of the grade 20-7 B preselectionned for the fabrication of pressure tubes. A very large dispersion of the results is attributed to the nonhomogeneity of the powders. Actual tolerances obtained in the fabrication of fuel element and pressure tubes are given. Influence of annealing on the properties, anisotropy of the semi-finished products properties, and influence of thermal cycling on the mechanical properties are reported. (auth)

27758 (HW-69204) PNEUMATIC INJECTION CASTING OF ALUMINUM–PLUTONIUM FUEL ELEMENTS. R. K. Koler (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Apr. 1961. Contract AT (45-1)-1350. 16p.

A process was developed for the injection casting of 90-in.-long plutonium alloy fuel rods within a glove box. Cast-bonded Al–2 wt.% Pu–2 wt.% Ni alloy ½-in.-diam. rods with 0.035-in. Zircaloy cladding were made with densities over 95% of wrought density. Core-to-clad bond shear strengths of 3000 to 4500 psi were measured, and ultrasonic testing of a seven-rod irradiation cluster showed good bond uniformity. It was demonstrated on a laboratory scale that aluminum–plutonium fuel elements can be fabricated by pneumatic injection casting. No conclusions can be drawn concerning the unit cost of injection-cast fuel elements as compared with extruded-core elements, since the prototypic equipment was not operated long enough to establish bases for such data. Difficulty was encountered in meeting the specifications pertaining to plutonium distribution. This problem was in part due to equipment limitations and was not completely resolved. A study of the ternary system in the high aluminum range would help account for some of the anomalies found in the alloy castings. (auth)

27759 (MAB-139-M(R3)) RECOMMENDED RESEARCH PROGRAMS FOR ROLLING. THIRD PROGRESS REPORT BY THE PANEL ON ROLLING OF THE COMMITTEE ON THE DEVELOPMENT OF MANUFACTURING PROCESSES FOR AIRCRAFT MATERIALS. (National Research Council. Materials Advisory Board). May 2, 1963. 62p.

References to rolled products, plus a review of process problem areas which may be significant in the 1965-1980 time period are considered. These problems are compared with the present state of the art and fifty-five research programs are recommended. (auth)

27760 (NP-12901) THE INVESTIGATION OF EXOTHERMIC BRAZING OF REFRACTORY ALLOYS. Quarterly Report No. 2, February 1, 1963 through April 30, 1963. R. O. Banning, J. R. Armstrong, and R. A. Long (Narmco Research and Development. Div. of Telecomputing Corp., San Diego, Calif.). May 28, 1963. Contract N600(19)59237. 28p.

Exothermic reactions (internal exotherms) that produce a braze alloy, a fluxing ceramic phase, and part of the heat required for brazing were investigated for brazing refractory metals. Acceptable joints were obtained with internal exotherms yielding a nickel–manganese braze alloy; however, those designed to yield a more refractory alloy (liquidus in excess of 3000°F) were not successful. Exothermic reactions (external exotherms) which act as a heat source were also investigated for their application to brazing refractory metals. Acceptable joints were obtained with all the refractory metals and alloys investigated (tungsten, tantalum, columbium, molybdenum, and TZM alloy) using braze filler alloys which melt at temperatures up to 3100°F. Data on the effect of the exothermic heating cycle on the various refractory base metals were obtained using tensile and microhardness evaluations as well as metallographic examination. (auth)

27761 (TID-18871) ULTRASONIC INVESTIGATION OF STAINLESS STEEL WELD OVERLAY. W. C. McGaughey and A. M. Murdoch (Sperry Products, Inc., Danbury, Conn.). May 21, 1963. Contract AT(11-1)-1136. 28p.

Methods successfully employed in the detection of inclusion- and slag-type defects in stainless steel overlay cladding using a twin-angle beam ultrasonic test technique are presented along with test data. A test method for detection of vertical cracking transverse to the weld overlay bead is developed. The design and operation of a twin variable angle search unit capable of introducing angles of zero through 70 degrees from each of the twin units at frequencies of 2¼ and 5 mc are described. Vertical cracking is detected from the carbon steel side of the stainless overlay cladding. This technique projects the beam at an angle through the carbon steel into the stainless steel striking the vertical reflector, reflecting from that vertical reflector to the stainless steel air interface, then back to the angle beam search unit on a parallel path to the incident beam. Good correlation is obtained between ultrasonic inspection and the radiographic picture of the sample. (N.W.R.)

27762 (EURAEC-368) URANIUM OXIDE EXTRUSION. Final Report (2nd Year). R. Hauser (Compagnie Industrielle des Combustibles Atomiques Frittes, Corbeville, par Orsay (Seine-et-Oise), France). Mar. 1963. Work Performed under United States–Euratom Joint Research and Development Program. Contract 030-60-9 RDF. 32p. (EUR-89.f). A translation.

Activities in a development program for fabrication of dense UO_2 are reported. Emphasis was placed on the effects of parameters relating to the choice of starting materials, preparation of pastes, and shaping. It was found that the preparation of dense cylindrical UO_2 rods by extrusion is feasible without the addition of mineral oxides. Test results also indicate that the physical and chemical properties of the extruded rods and compressed pellets are comparable after sintering. Fabrication of UO_2 by extrusion appears to be more economical than pelletization. (J.R.D.)

27763 A CHEMICAL POLISHING FOR URANIUM DIOXIDE. A. Bassi and G. Camona (CISE, Milan). Energia Nucl. (Milan), 10: 277-9(May 1963). (In English)

Two baths were developed for the chemical polishing of UO_2: H_2CrO_4–HF–H_2O and CH_3CH_2COOH–H_2CrO_4–HNO_3–HF. They are used for samples prepared only by grinding with silicon carbide paper. Results are shown in figures. (M.C.G.)

27764 MULTICYCLE REPROCESSING AND REFABRICATION EXPERIMENTS ON SINTERED UO_2-FISSIA PELLETS. Sydney Strausberg and E. W. Murbach (Atomics

International, Canoga Park, Calif.). Ind. Eng. Chem., Process Design Develop., 2: 228-31(July 1963).

A multicycle reprocessing and refabrication scheme was simulated (using UO_2 "spiked" with fissia) to evaluate the feasibility of refabricating high-burnup UO_2 to a cumulative level of 10^5 Mwd/MTU. Various powder characteristics were studied, using oxidation-reduction methods as the reprocessing scheme. Processing conditions were established for the multicycle tests. Fissia, typical fission products (mostly oxides), were added to the reprocessed powder prior to compacting operations. There should be no difficulty in refabricating pellets from high-burnup material; conversely, the sinterability of UO_2 containing comparatively large concentrations of fissia is even enhanced. Well-formed pellets of density near 98% of theoretical were made for simulated burnups of 60,000, 80,000, and 100,000 Mwd/MTU. Cesium was the only fission element removed during processing. (auth)

27765 MELTING AND CASTING BERYLLIUM. John P. Denny and William H. Santschi (Beryllium Corp., Reading, Penna.). Metal Progr., 84: No. 1, 111-13; 126; 128; 130; 132(July 1963).

Commercial-grade and high-purity beryllium ingots up to 6 in. in diameter can be produced by vacuum-induction, consumable-arc, and electron-beam melting techniques. Since ductilities are adequate, sheet is readily rolled from as-cast material. (auth)

27766 ACTIVATED SINTERING OF URANIUM DIOXIDE FUEL. II. SINTERING IN WET HYDROGEN AND IN VACUUM. Kazuo Maruya, Shuichiro Takahashi, Kazuo Yamamoto, and Yutaka Honda (Mitsubishi Atomic Power Ind., Inc., [Japan]). Nippon Genshiryoku Gakkaishi, 5: 395-403(May 1963). (In Japanese)

The effect of sintering atmospheres and additives on the sintering rate and grain growth of UO_2 was examined. The main results are summarized as follows: (1) Vacuum atmosphere accelerates the sintering rate of UO_2 powder. It would be mainly due to the acceleration of diffusion phenomena by the presence of excess oxygen ion, and partially due to the vaporization and condensation near the surface of UO_2 particles and open pores. (2) TiO_2 addition pronouncedly accelerates the sintering rate and grain growth of UO_2 powder, because TiO_2 (or lower oxide of Ti) locally forms an eutectic of low melting point with UO_2 and it accelerates the diffusion of oxygen ion. (3) BeO and Al_2O_3 are not soluble in UO_2, and these minute addition (0.01 ~ 0.03%) are able to accelerate the sintering rate of UO_2. Eutectic points of UO_2–BeO, and UO_2–Al_2O_3 systems are very high and cross sections of thermal neutron absorption are very low. So, both BeO and Al_2O_3 are considered to be desirable additives. (4) Al_2O_3 improves the stoichiometry of UO_2, but it delays the sintering rate of UO_2 in vacuum. (auth)

27767 SINTERING OF NITRIDES OF TRANSITION METALS. G. V. Samsonov and T. S. Verkhoglyadova. Poroshkovaya Met., Akad. Nauk Ukr. SSR, No. 2, 8-12 (Mar.-Apr. 1963). (In Russian)

The conditions of the sintering of nitrides of the transition metals Ti, Zr, Hf, V, Nb, Ta, Cr, and Mo are investigated in a vacuum by the method of hot pressing and reactive sintering. The optimal sintering conditions are established by each of these methods, and the advantages of the reactive sintering method are shown. The correlation between the sintering process and the nature of the electron density distribution in the nitride phase lattices is also shown. (auth)

27768 WELDING TANTALUM FOR HIGH TEMPERATURE APPLICATIONS. A. E. Miller, A. H. Daane, C. E. Habermann, and B. J. Beaudry (Ames Lab., Ames, Iowa). Rev. Sci. Instr., 34: 644-7(June 1963).

A device is described which can be used to weld tungsten, tantalum, and molybdenum. The general problem of fabricating tantalum process equipment from tantalum sheet is discussed. (auth)

27769 IMPROVEMENTS IN OR RELATING TO THE ELECTROPLATING OF URANIUM. (to European Atomic Energy Community). British Patent 928,507. June 12, 1963. Priority date Jan. 14, 1961, Italy.

Electroplating U, which is electrolytically etched in an aqueous solution of nitric or sulfuric acid at 6 v d-c, with a bath of nickel sulfate, sodium citrate, ammonium chloride, and wetting agent at a pH of 4.5, a current density of 1.5 amp/dm^2, and a temperature of 20°C gives an even nickel plating that is not porous. The plating adheres well to the U and to the Al that encloses U fuel rods and effectively inhibits U diffusion into the Al. (D.C.W.)

27770 CEMENTING PROCESS FOR CARBON ARTICLES. William Johnson and William Watt (to United Kingdom Atomic Energy Authority). British Patent 929,463. June 26, 1963. Filed Dec. 17, 1957.

A process is given for cementing together carbon components which are to be used at high temperatures, e.g., 1000 to 2500°C. The process comprises coating the surface of one component with a cement consisting mainly of furfuryl alcohol, contacting the two components, resinifying the cement, and finally carbonizing the cement by heating to above 1000°C in an inert atmosphere. The cement may be furfuryl alcohol alone or in admixture with furfuraldehyde, and a resinifying agent such as mineral acid is added to the cement. Phosphoric acid may also be added to the cement to improve the oxidation resistance of the final product. (D.L.C.)

27771 CARBON ARTICLES. William Johnson and William Watt (to United Kingdom Atomic Energy Authority). British Patent 929,464. June 26, 1963. Filed Nov. 4, 1958.

A process is given for improving the oxidation resistance of low-permeability graphite prepared by impregnation with furfuryl alcohol. The process comprises treating the impregnant with phosphoric acid or a phosphorus compound in an amount less than 10 vol % and subsequently carbonizing the impregnated graphite at 1000°C. (D.L.C.)

27772 TUBULAR CARBON ARTICLES. Robert Lewis Bickerdike, Anthony Reginald George Brown, Garyth Hughes, William Johnson, and William Watt (to United Kingdom Atomic Energy Authority). British Patent 929,465. June 26, 1963. Filed Feb. 10, 1959.

A process is given for making impermeable composite graphite tubes from porous component tubes. The process comprises treating at least one component tube to deposit carbon in the pores of the annular surface thereof, and uniting the treated tube with another component tube by a carbon bond so that the impermeable, treated surface does not form part of the exterior surface of the composite tube. The treatment may comprise heating in a nitrogen–benzene atmosphere at ~850°C and/or furfuryl alcohol impregnation, and a furfuryl alcohol adhesive may be used for making the carbon bond between the component tubes. (D.L.C.)

27773 METHOD FOR PRODUCING HIGH DENSITY URANIUM OXIDE. Kasimir Langrod (to Sylvania Electric Products Inc.). U. S. Patent 3,094,377. June 18, 1963. Filed Mar. 29, 1960.

A method is given for producing UO_2 pellets with a density 95% of theoretical density, using relatively low temperatures and pressures. The method comprises mixing UO_2 and U_3O_8 or oxidized scrap UO_2 to give an O/U ratio of 2.20 to 2.40, adding a binder, pressing the mixture at 10 tsi, sintering for 2 hr at 1300 to 1315°C in N_2, reducing the compacts for 10 min at 1300°C in H_2, and finally cooling slowly in H_2. (D.L.C.)

Properties and Structure

Refer also to abstracts 27398, 27960, 27961, 27962, 27966, 27969, 27970, 27971, 27972, 27973, 27975, 27976, 27977, 27978, 28101, 28466, 28467, 28468, 28470, 28493, and 28565.

27774 (ANL-6657) A STUDY OF THE THERMODYNAMIC PROPERTIES OF THE VANADIUM–IRON ALLOY SYSTEM. Kevin Michael Myles (Argonne National Lab., Ill.). Feb. 1963. Contract W-31-109-eng-38. 59p.

The vapor pressure of iron over vanadium-iron alloys was measured by the torsion-effusion method in the temperature range from 1500 to 1700°K. The chemical activities, as well as the free energies, entropies, and enthalpies of formation, of the alloys were computed from the vapor pressure data. The activities of iron exhibited large negative deviations from Raoult's law throughout the entire compositional range. Although the activities of vanadium, as determined by the Gibbs-Duhem relation, deviated negatively from ideal behavior in the iron-rich alloys, nearly ideal behavior was observed in the vanadium-rich alloys. Large positive excess entropies and enthalpies of formation were found at 1600°K. An attempt was made to interpret these quantities in terms of the various configurational, vibrational, and magnetic changes that occur in this system on alloying. (auth)

27775 (ATL-A-135) INVESTIGATION OF THERMAL-STRESS-FATIGUE BEHAVIOR OF STAINLESS STEELS. Quarterly Progress Report No. 5, January–March 1963. K. E. Horton (Advanced Technology Labs. Div. of American-Standard, Mountain View, Calif.). Work performed under United States–Euratom Joint Research and Development Program. Contract AT(04-3)-250. 36p. (EURAEC-632)

The program to date has emphasized the requirement that the thermal-stress-fatigue (TSF) data generated on type 304-L stainless steel be valuable to as large an audience as possible. It is planned to have the equations allowing the prediction of TSF life be valid regardless of actual test conditions, hence assuring the designer, and in particular the reactor designer, that his particular TSF problem on 304 stainless can be solved by using the equations generated in this program. A new TSF specimen was designed that theoretically allows measurement of the true plastic strain range (which is the most important data obtained from testing). Associated with this new-specimen testing program, parallel study was almost completed on the effect of gage length on apparent TSF life. These two studies also enable the extrapolation of data obtained in this program with TSF data obtained by different methods at other laboratories. (auth)

27776 (BNL-6358) RESISTIVITY OF VACANCY IMPURITY PAIRS. Joseph M. Keller (Iowa State Univ. of Science and Tech., Ames. Inst. for Atomic Research and Brookhaven National Lab., Upton, N. Y.). [1962]. Contract [AT(30-2)-Gen-16]. 21p.

The contribution to electrical resistivity of impurity atoms adjacent to vacancies in metals is calculated. The calculation is based on the Born approximation, which allows separation of the effects of the individual imperfections from interference effects. Lattice relaxation is neglected. The resistivity due to Ag or Zn impurities adjacent to a vacancy in Au is related to the resistivity of the separate imperfections as $\rho_{Ag+vac} = \rho_{Ag} + \rho_{vac} - 0.11\,(\rho_{Ag} + \rho_{vac})^{1/2}$; $\rho_{Zn+vac} = \rho_{Zn} + \rho_{vac} + 0.10\,(\rho_{Zn} + \rho_{vac})^{1/2}$. Effects of anisotropy of the scattering are found to be almost completely removed if the vacancy-impurity pairs are randomly oriented along the several (110) directions. (auth)

27777 (CW-R&DL-31) ANNUAL REPORT ON BERYLLIUM RESEARCH, 1962. C. Steel and G. S. Armitage (Canadian Westinghouse Co., Ltd. Research and Development Labs., Hamilton, Ont.). Mar. 1963. 67p. (AECL-1715)

High temperature mechanical properties were evaluated for two grades of warm extruded Be rod. Both show an improvement over hot extruded material in ductility and consistency of properties at elevated temperatures, with little or no loss in strength. By suitable heat treatment ductility at elevated temperatures may be improved with little adverse effect on strength. No method was found to increase room temperature ductility. Mechanical tests on two analyses of rod having a nearly random orientation showed the effect played by extrusion on rod. While the yield stress was not altered, ductility was very low even with optimum heat treatment. The material did, however, show remarkably consistent results. Longitudinal tensile tests were made on Brush tubes with pressure welded end plugs in order to test the efficiency of the welding technique and to give a correlation of data between rod and tube mechanical properties. Burst tests, using warm extruded tubing at elevated temperatures initially gave scattered results, but much of this was attributable to tube defects and unsuitable welding technique. Improvements in the weld gave results of greater consistency. Hot extruded ICI (AGR type) tube, while only showing a small degree of scatter, gave ultimate hoop stresses lower than those for warm extruded Brush tubing. (P.C.H.)

27778 (DMIC-183) BINARY AND TERNARY PHASE DIAGRAMS OF COLUMBIUM, MOLYBDENUM, TANTALUM, AND TUNGSTEN. J. J. English (Battelle Memorial Inst. Defense Metals Information Center, Columbus, Ohio). Feb. 7, 1963. Contract AF33(616)-7747. 131p.

Supplement to DMIC-152.

A compilation of binary and ternary phase diagrams of the four refractory metals Nb, Mo, Ta, and W are presented. Included with each binary diagram and with some ternary diagrams is a short discussion which lists information such as maximum solubility and crystal structures of intermediate phases. (auth)

27779 (DRI-2102) DETERMINATION OF THE NIOBIUM-RICH REGION OF THE TERNARY PHASE DIAGRAMS, NIOBIUM–TUNGSTEN–HAFNIUM AND NIOBIUM–TUNGSTEN–ZIRCONIUM. Quarterly Report No. 3. Albert S. Yamamoto and Charles E. Lundin (Denver. Univ. Denver Research Inst.). June 1963. Contract AT(11-1)-1092. 8p.

An additional high-vacuum, tantalum-tube resistance heating furnace under construction was completed and tested for performance. The Nb–W–Hf alloys are being currently homogenized and will be isothermally annealed at 1600, 1300, and 1100°C. The alloy preparation for the Nb–

W–Zr system was initiated. A continued but diminishing amount of effort is being expended on the Nb–Al–Zr system. The hardness data for the ternary alloys annealed at 1100°C were modified after reexamination. (P.C.H.)

27780 (DRI-2104) AN INVESTIGATION OF THE EFFECT OF METALLIC ADDITIONS UPON THE OXIDATION RESISTANCE OF TITANIUM-MODIFIED $NbAl_3$. Quarterly Progress Report No. 3, March 1, 1963–May 31, 1963. Walter Wheatfall and Donald T. Klodt (Denver. Univ. Denver Research Inst.). June 1963. Contract AT(11-1)-1092. 28p.

The air-oxidation resistance of an $(Nb–Ti)Al_3$ compound with alloy additions of tin and silicon is being investigated. Thermogravimetric determinations of the weight gain/cm^2 in air over a 24-hour period are being made on arc-melted alloys at 760 to 1360°C. Oxidation data for the complete series of the tin-addition alloys and several of the silicon-addition alloys are presented. The silicon-addition alloys exhibit a considerably higher maximum specific weight gain in 24 hours than the tin-addition alloys. Several silicon-addition alloys are subject to severe cracking during the oxidation exposure. (auth)

27781 (DRI-2105) INTERMEDIATE-TEMPERATURE OXIDATION OF BERYLLIDES. Quarterly Progress Report. Frank C. Perkins (Denver. Univ. Denver Research Inst.). June 12, 1963. Contract AT(11-1)-1092. 15p.

The oxidation characteristics of aluminum-containing modified $ZrBe_{13}$, Zr_2Be_{17}, $NbBe_{12}$, and Nb_2Be_{17} were studied in the temperature range 650 to 1000°C. The oxidation resistances of the modified beryllides in the intermediate temperature range (between 700 and 1000°C) with one exception were greatly superior to those of the unmodified materials. The breakaway phenomenon was exhibited only in the instance of $ZrBe_{13}$ at 871°C in which specimen preparation was a factor. Modified Zr_2Be_{17} and Nb_2Be_{17} tended to oxidize more severely at 1093°C than the corresponding Al-free materials. X-ray analysis of the modified beryllides after oxidation indicated some differences in the products of oxidation as compared to the normal or unmodified beryllide materials. The principal difference was the appearance of an unknown phase that was detected consistently in almost all of the zirconium beryllide specimens. In all instances BeO was the principal oxide present on the modified beryllides. (P.C.H.)

27782 (GA-3194) THE PORE STRUCTURE OF GRAPHITE AS IT AFFECTS AND IS AFFECTED BY IMPREGNATION PROCESSES. G. R. Tully, Jr., and B. F. Disselhorst (General Atomic Div. General Dynamics Corp., San Diego, Calif.). Apr. 30, 1963. Contract AT(04-3)-314. 54p.

The best test for determining the suitability of a graphite for impregnation treatment is a Hg-intrusion pore spectrum. Five principle grades of graphite considered for HTGR reactor sleeve base stock are characterized by their pore spectra. Material with a maximum apparent pore size of ~1 μ responded to a single impregnation, and that with a maximum pore of ~45 μ required 5 or 6 treatments. Metallographic sections of the different stocks before and after impregnation are compared. Pertinent properties of the graphites are given. (auth)

27783 (GA-4227) A PROGRAM OF BASIC RESEARCH ON MECHANICAL PROPERTIES OF REACTOR MATERIALS. Quarterly Progress Report for the Period Ending March 31, 1963. T. A. Trozera, J. Schultz, and J. L. White (General Atomic Div. General Dynamics Corp., San Diego, Calif.). June 3, 1963. Contract AT(04-3)-167. 30p.

Deformation and fabrication characteristics of reactor materials are being studied. The effects of room-temperature prestrain on the early flow characteristics of tantalum single crystals at 77°K were analyzed. Results indicated an increase in mobile dislocation density of 16 times in going from 1 to 10% strain at room temperature. Dislocation mobility in Fe–Si crystals was analyzed in terms of their stress dependence. Work on specimen preparation was directed toward preparing and purifying foils. The rate-controlling process for plastic flow in metals at low temperatures may be the same process as that which produces a low-temperature internal friction maximum, the α-peak, found in low-amplitude oscillatory experiments. Methods of identifying the mechanism are being investigated. The model developed for the α-peak mechanism is that it is a linear superposition of a distribution of stress-biased, thermally activated relaxation of kinks over potential barriers. Niobium samples were used to test the model in internal-friction measurements. Studies are also being made of the effects of material variables on stored-energy release in deformed iron. Results indicate that the total stored energy in deformed iron is small relative to that in fcc metals, that there is an appreciable grain-size effect in iron, and that the stored-energy releases associated with recovery processes are not large. (M.C.G.)

27784 (GA-4267) FISSION-PRODUCT RELEASE FROM "SINGLE-CRYSTAL" UC_2 PARTICLES. L. R. Zumwalt, P. E. Gethard, and E. E. Anderson (General Atomic Div. General Dynamics Corp., San Diego, Calif.). June 5, 1963. Contract AT(04-3)-167. 36p.

The fission-product release of spherical single-crystal UC_2 particles was studied by means of postirradiation annealing of neutron-activated samples and by exposing samples to a steady rate of photofission, using 30-Mev x rays. The release of the several fission products studied appears to follow the kinetics and temperature-dependence of an activated diffusional process. The anomalous fast release of a portion of the Xe^{133} in annealing experiments may be interpreted as being due to release of attached or trapped xenon atoms by a process not following Fick's law (i.e., by a nondiffusional process). Analysis of the data obtained gives the following diffusion coefficients for krypton, tellurium, iodine, xenon, and barium in UC_2 (in cm^2/sec): $D_{Kr} = (6.2 \times 10^{-5})\exp(-44{,}000/RT)$, $D_{Te} = (1.26 \times 10^{-5})\exp(-67{,}000/RT)$, $D_I = (4.1 \times 10^{-8})\exp(-53{,}300/RT)$, $D_{Xe} = (4.6 \times 10^{-6})\exp(-68{,}000/RT)$, and $D_{Ba} = (2.0_4 \times 10^{-7})\exp(-49{,}000/RT)$. The diffusion coefficient for xenon in UC_2, expressed by the equation $D = D_0 \exp(-Q/RT)$, showed remarkable agreement, both as to D_0 and Q (the activation energy for diffusion), with the diffusion coefficient for xenon in UO_2 selected by Lustman. A negative activation entropy (–13 eu) for diffusion was found from D_0. (auth)

27785 (IS-569) THE SCANDIUM–YTTRIUM AND SCANDIUM–ZIRCONIUM SYSTEM. B. J. Beaudry and A. H. Daane (Ames Lab., Ames, Iowa). [Oct. 26, 1962]. Contract [W-7405-eng-82]. 14p.

The scandium–yttrium and scandium–zirconium systems were studied by thermal and x-ray methods. Both systems are characterized by complete solid solubility in the low temperature hexagonal form and in the high temperature bcc form. In the Sc–Y system, there is a minimum in the solidus at 50 at. % and 1365°C, while the solidus in the Sc–Zr system follows a nearly straight line relationship between the melting point of a scandium and zirconium. There is a minimum in the temperature of transition from hexagonal to bcc in the Sc–Y system at

43 at. % Y and 1175°C; while the temperature of transition is raised in the Sc–Zr system to a maximum of 1415°C at 30 at. % Zr. (auth)

27786 (LADC-5522) INTERPRETATION OF MONOCLINIC POWDER X-RAY DIFFRACTION PATTERNS. W. H. Zachariasen (Chicago. Univ.). [nd]. Contract [W-7405-eng-36]. 18p.

The procedure used to index the monoclinic powder diffraction patterns of alpha and of beta plutonium metal is described. (auth)

27787 (LADC-5523) THE CRYSTAL STRUCTURE OF ALPHA PLUTONIUM METAL. W. H. Zachariasen (Chicago. Univ.) and F. H. Ellinger (Los Alamos Scientific Lab., N. Mex.). [1961]. Contract [W-7405-eng-36]. 33p.

Alpha plutonium is monoclinic with 16 atoms in the unit cell which at 21°C has dimensions a = 6.183, b = 4.822, c = 10.963 Å, and β = 101.79°. The space group is $P2_1/m$, and all atoms lie in reflection planes. The atomic position parameters were determined to a precision of 0.03 Å. Six of the eight kinds of plutonium atoms form four short bonds of length 2.57 to 2.78 Å and ten long bonds of length 3.19 to 3.71 Å. Five short and seven long bonds are formed by the seventh plutonium atom, and three short and thirteen long bonds by the eighth atom. (auth)

27788 (LRR-41) EQUILIBRIUM STUDIES OF REFRACTORY METAL OXIDES. Final Report, June 15, 1961–June 14, 1963. L. J. Fiegel, G. P. Mohanty, and J. H. Healy (Smith (A. O.) Corp. Long Range Research Lab., Milwaukee). Contract AT(11-1)-1048. 49p.

Equilibrium diagrams of the Nb_2O_5–Ta_2O_5 and Nb_2O_5–WO_3 systems were investigated. Some modifications were made in the diagram of the Nb_2O_5–Ta_2O_5 system as reported by Holtzberg and Reisman. The compound $2Nb_2O_5 \cdot Ta_2O_5$ was indexed, and a tetragonal unit cell and possible space groups were established for it. A tentative diagram of the Nb_2O_5–WO_3 system was also proposed with the existence of two new possible compounds being indicated at the 60% Nb_2O_5–40% WO_3 and 50% Nb_2O_5–50% WO_3 compositions. The compound $Nb_2O_5 \cdot 3WO_3$ was indexed as tetragonal as reported by Kovba and Trunov, and possible space groups were established for it also. (auth)

27789 (MLM-1156) REACTOR FUELS AND MATERIALS DEVELOPMENT. PLUTONIUM RESEARCH, JANUARY–MARCH 1963. L. V. Jones and L. J. Wittenberg (Mound Lab., Miamisburg, Ohio). May 29, 1963. Contract AT(33-1)-Gen-53. 27p.

Solvent extraction methods were investigated as an analytical technique for Ce–Cu–Pu alloys. Analysis of Fe–Pu alloys proved that Pu III-o-phenanthroline complexes (if formed at all) do not interfere with spectrophotometric Fe determination at 515 millimicrons. A controlled potential coulometric method in which Fe is analyzed in the presence of Pu because of a suitable separation in the oxidation-reduction potentials was developed and tested with encouraging results. A high temperature calorimeter for measuring specific and latent heats in phase transformations of potential Pu fuel systems and for determining thermal conductivities was also developed. The thermal conductivity of Ni was measured in agreement with other determinations. An induction-coupled plasma torch producing temperatures up to 20,000°K and permitting melting of ceramics in inert, oxidizing, or reducing atmospheres was used to produce contamination-free microspheres of PuO_2 and Pu-bearing ceramics. Boron and yttrium microspheres showing no oxidation were also produced. Phase equilibria, solidus temperatures, boundary intersections, ternary phase diagrams, and liquidus temperatures were among the aspects studied in analyses of Ce–Co–Pu, $CeCu_6$–Pu_4Cu_{17}, and Ce–Ni–Pu systems. Pu/U homogeneity was investigated for UC–PuC systems; the concentration of Ni added to this system as a sintering aid was also examined. The viscosities of some Ce–Co–Pu alloys were measured by an absolute method from their melting points to 1000°C in an oscillating-cup viscosimeter. Zirconium oxide viscosity capsule liners were evaluated for measuring the viscosity of Bi and were found acceptable. Zirconia liners can also be used for liquid Pu alloy measurements up to 1300°C. (D.C.W.)

27790 (NAA-SR-Memo-8408) PRE-IRRADIATION METALLOGRAPHY ON NAA 47 FUELS. S. L. Englebert (Atomics International. Div. of North American Aviation, Inc., Canoga Park, Calif.). Apr. 16, 1963. Contract AT-11-1-GEN-8. 8p.

Metallography was conducted on HNPF fuels to determine the preirradiation condition and set procedures for metallographic examination of U10 Mo fuels. (auth)

27791 (NLCO-862(Rev.4)) THE INVERSION OF POLE FIGURES FOR MATERIALS HAVING ORTHORHOMBIC SYMMETRY. Peter R. Morris, John W. Colby, and James F. Niedermeyer (National Lead Co. of Ohio, Cincinnati). June 12, 1963. Contract AT(30-1)-1156. 30p.

A method for inverting pole figures for materials having orthorhombic symmetry is described. The method entails expansion of the axis distribution function in a series of polynomials of appropriate symmetry, even in x_1, x_2, x_3. Truncation of the series at order n = 2, 4, 6, 8---requires the solution of n/8 (n + 6) simultaneous equations in as many unknowns obtained from m pole figures, where $m \geq (n + 6)/4$. A method for evaluating the accuracy of fit of the inversion process is suggested. (auth)

27792 (NP-12933) THE SPECIFIC HEAT FROM 0 TO 1150°C AND HEAT OF FUSION OF POTASSIUM. H. W. Deem, E. A. Eldridge, and C. F. Lucks (Battelle Memorial Inst., Columbus, Ohio). Aug. 31, 1962. Contract NAS 5-584. 33p. (BATT-4673-T2)

The enthalpy and specific heat of potassium from 0 to 1150°C and its heat of fusion at 63.2°C were determined by data obtained with a Bunsen ice calorimeter. The potassium was contained in Nb–1Zr capsules for the measurements. Measured enthalpy values were corrected for the effect of potassium vapor above the liquid and for slight external oxidation of the capsules. The equations obtained for specific heats of potassium were C_s (solid) = $0.1705 + 0.4190 \times 10^{-3}$ t (0 to 63.2 C) and C_s (liquid) = $0.2004 - 0.8777 \times 10^{-4}$ t + 1.0970×10^{-7} t^2 (63.2 to 1150 C), where C_s = cal g^{-1} C^{-1} and t = temperature, C. (auth)

27793 (NP-12938) THERMODYNAMIC PROPERTIES OF MOLYBDENUM AND COLUMBIUM. AN ANNOTATED BIBLIOGRAPHY. Jack B. Goldmann, comp. (Lockheed Missiles & Space Co., Sunnyvale, Calif.). June 1963. 80p. (SB-62-69)

The data included encompass heat of formation, activity, entropy, diffusion rates, and diffusion constants. References on research, tests, and instrumentation are given. The period covered is 1924–1962, with special emphasis on the literature published since 1955. An author index is provided for the 184 references. (auth)

27794 (NRL-5949) TRANSVERSE MAGNETORESISTANCE OF ALUMINUM. J. Babiskin and P. G. Siebenmann (Naval Research Lab., Washington, D. C.). Mar. 13, 1963. Contract AT(4902)-1166. 6p.

The transverse magnetoresistance of Al was studied. The measurements were made on six samples of 99.999% pure Al at 4.2°K in magnetic fields H up to 120000 gauss, the samples having been annealed, and in two cases cold-

worked, so as to be in various states of strain. Valid data were obtained from four of the samples, for which the ratios (at H = 0) of room temperature resistivity $R_{300°K}$ to the resistivity R at 4.2°K were 1530, 1180, 1075, and 333. Since $R_{300°K}$ is essentially the same for all the samples, the ratios are proportional to the R values, which for two of the samples can be seen to be in the ratio 1530/333 or approximately 4.6. At H = 80,000 gauss, the ratio was still 4.4, showing that almost all of the resistivity decrease gained at H = 0 by using a less strained metal is preserved at high magnetic fields for a metal whose magnetoresistance exhibits a predominantly saturating behavior. The data from the four samples were normalized fairly well by Kohler's rule, which is $\Delta R/R = f(HR_{300°K}/R)$, where ΔR is the increment to R due to the magnetic field. This indicates that further reductions in the power necessary to operate cryogenic magnets can be profitably achieved by using purer and purer Al. (auth)

27795 (ORNL-3438) INVESTIGATION OF THE WETTABILITY OF VARIOUS PURE METALS AND ALLOYS ON BERYLLIUM. Ralph Gerald Gilliland (Oak Ridge National Lab., Tenn.). June 13, 1963. Contract W-7405-eng-26. 95p.

Thesis submitted to University of Tennessee, Knoxville.

Activities in a program to determine the wetting behavior of pure metals such as Au, Ag, Ge, Al, and Cu on solid Be are reported. Results of similar investigations of binary alloys such as Be–Tl, Be–Zr, and Be–Pd are also included. The contact angles of the molten metals on Be as a function of temperature, exposure time, and atmosphere were measured. The solid-liquid interfacial reactions occurring as a function of test temperature and atmosphere were investigated, and the liquid-vapor and internal surface tensions for those systems in which interfacial reactions did not appear to occur were calculated. (J.R.D.)

27796 (ORNL-TM-521) METALLOGRAPHIC EXAMINATION OF PYROLYTIC-CARBON COATED AND UNCOATED URANIUM CARBIDE PARTICLES. C. K. H. DuBose (Oak Ridge National Lab., Tenn.). June 25, 1963. Contract W-7405-eng-26. 127p.

Samples of commercially produced pyrolytic-carbon coated and uncoated UC–UC_2 spheroidal particles, both unsupported and in graphite matrices, were examined metallographically. The purpose of this investigation was to evaluate the microstructure of the particles and coatings in the as-received condition, after various heat treatments, and after fabrication in a graphite matrix. Those factors studied included coating integrity, identification of reaction products, and the presence of any extraneous phases. The spheroidal carbide particles consisted primarily of UC_2 with platelets of UC. Some carbide particles of several different batches revealed abnormal etching behavior of the UC platelets. "Anomalies" of this type fell into three classifications: the UC platelets were wider than normal in some areas and had a light-gray color, they swelled above the polished surface and had a black coloring, or they became very narrow and coalesced near flakes of free graphite. X-ray diffraction studies of individual carbide particles exhibited a deviation from the normal UC lattice parameter that was directly related to their unusual etching characteristics. The microstructures of the pyrolytic-carbon coatings examined had either of two characteristics: multiple layers of laminar or "onion-ring" type structure or columnar-grain type. Examples of duplex pyrolytic-carbon coatings of "onion-ring" type with an outer coating of columnar-grain type structure were also examined. A reaction layer at the interface between the uranium carbide particle and the laminar-type coating was observed in materials that had been heat treated at 1800°C and above. This type of reaction was not observed in any of the particles having the columnar-type coating. (auth)

27797 (PAN-414/V) STOPIONE CHLORKI PLUTONU I URANU JAKO PALIWO DLA PREVKICH REAKTOROW. (Fused Plutonium and Uranium Chlorides as Fuel for Fast Breeder Reactors). M. Taube (Polish Academy of Sciences. Inst. of Nuclear Research, Warsaw). Mar. 1963. 204p.

Nuclear and chemical properties of liquid salt components as nuclear fuel for fast breeder reactors are discussed. The properties dealt with are elastic and inelastic neutron scattering, neutron capture, melting point, vapor pressure, thermal and chemical stability, anticorrosion properties, and others. For fast breeder two-region reactor (1000 Mw(t), $\phi = \sim 10^{15}$ ncm^{-2} sec^{-1}) the composition of uranium plutonium liquid salt fuel is evaluated. The postulated continuous process of purification of irradiated core fuel material and periodical purification of blanket material results in a relatively high breeding ratio. The chemical properties of fused salt fuel are determined by its components: plutonium (fissionable material), uranium (fertile material), and partly also by americium and curium (nuclear synthesis products) and fission products; but above all by fused salt diluents, that is by chlorides of alkali metals and alkaline earth metals. The proposition of using some low-melting eutectic mixtures of chlorides as model salts for experimental investigation is discussed. Chlorides of potassium and copper(I) or zinc(II) may be used. The experimental work concerned with fused chlorides of uranium(IV) and (III), plutonium(IV) and (III), and americium(III), diluted by chlorides of potassium and copper(I) or zinc(II). Results were based on extraction from fused salt media to high-boiling organic media (TBP, TOA, HDBP, and others) diluted by DFN and others, electromigration in salt media, and spectrophotometry (10–25 kK) in fused salt media and organic media. In the salt media the following species are present: cations: K^+, Cu^+, UCl_2^{2+}; non-ionized molecules: Cu_2Cl_2, UCl_4, UCl_3, $PuCl_3$; anions: $CuCl_2^-$, Cl^-, UCl_5^- or UCl_6^{2-}. Species in the organic media (in equilibrium state with fused salt media) are investigated and their formulas are proposed. (auth)

27798 (RADC-TDR-62-307) STUDY OF HIGH TEMPERATURE MATERIALS. Final Report. E. J. Smoke, J. Rooda, D. A. Molony, B. Kenner, R. Pecina, and C. Chao (Rutgers Univ., New Brunswick, N. J. School of Ceramics). Jan. 3, 1962. Contract AF30(602)-2058. 151p. (AD-287500)

The attenuation properties of ceramic materials over a range of frequency and temperature are being studied to obtain information which can be utilized in the design of absorbers. The frequencies selected are 100, 500, 1000, 3000, 8400, and 12,000 Mc. The temperatures selected are room temperature, 500, 1000, 1500, and 2300°F. Due to several unforeseen limiting factors the maximum temperature was reduced to 2000°F in some cases and 1350°F in others. Three series of ceramic compositions were selected in order to determine the effect of composition, bulk density, and several loss mechanisms. Thirty-five compositions were evaluated. For the evaluation of loss tangent dielectric constant a coaxial line was used over the frequency range 100 through 3000 Mc. A wave-guide system was utilized for frequencies above this range. The sample holders were made of Inconel and heated in a resistance furnace to attain the selected temperatures. The basic formula for computing loss tangent and dielectric constant over the

range of low-to-high loss was derived and programmed to an IBM 650 computer. Considerable difficulty was encountered in programming the formula resulting in the computing of approximately half the raw data. A discussion of the programming problem is presented. A discussion of the results along with the raw data and the calculated data is also presented. (auth)

27799 (TID-17092) A THERMODYNAMIC STUDY OF THE THORIUM–OXYGEN SYSTEM AT HIGH TEMPERATURES. R. J. Ackermann, E. G. Rauh, R. J. Thorn (Argonne National Lab., Ill.); and M. C. Cannon (Utah State Univ., Logan). July 1962. Contract [W-31-109-eng-38]. 29p. (UAC-6710)

The evaporation behavior of the thorium–oxygen system in the temperature range 2000 to 3000°K was studied. The results of effusion measurements of the dioxide phase, liquid metal–dioxide mixtures, and a mass spectrometric investigation of the former were combined to yield an internally consistent set of thermodynamic data for the system. The solid dioxide evaporates congruently at all temperatures. Above 2800°K there is a measurable but thermodynamically insignificant stoichiometry, $ThO_{1.998}$. The rates of mass effusion of thorium dioxide from a tungsten effusion cell were determined by measuring the total weight loss with a vacuum balance and by collecting a known fraction of the effusate on colled silica targets, the thorium content of which was determined subsequently by neutron-activation analysis. The data from both kinds of experiments are concordant and calculation of an "effective" pressure based on the assumption that the vapor is comprised entirely of dioxide molecules yields the equation, $\log p_e$ (atm) = (8.26 ± 0.13) − (3.552 ± 0.031) $10^4/T$. The dioxide and monoxide were identified as the principal vapor species and the temperature dependence of each was measured by means of a Bendix time-of-flight mass spectrometer. No significant concentrations of volatile tungsten oxides were revealed. The effusion rate of gaseous monoxide from liquid metal–dioxide mixtures was measured under conditions in which the mutual solubilities of the two phases were practically insignificant. The average heat and entropy of sublimation of the solid dioxide to $ThO_2(g)$ are 158.7 ± 2.5 kcal $mole^{-1}$ and 35.3 ± 1.0 eu, respectively, and the respective values for ThO(g) are 173.5 ± 2.2 kcal $mole^{-1}$ and 38.4 ± 1.0 eu. The standard free energies of formation of the gaseous thorium oxides are $\Delta F_f^0(ThO_2) = -138{,}000 + 11.4\ T$ (2000 to 3000°K) and $\Delta F_f^0(ThO) = -10{,}300 - 14.4\ T$ (2000 to 3000°K). Because the low-lying electronic states are not known, it is possible to set only an upper limit to the dissociation energies at absolute zero of both $ThO_2(g)$ and ThO(g); $D_0(ThO_2) \leq 16.3$ ev and $D_0(ThO) \leq 8.3$ ev. It was demonstrated that tungsten does not significantly reduce thoria at high temperatures and in view of the substantial reduction observed in the case of thoriated filaments by previous investigators, it is postulated and then confirmed by calculation that these observations can be explained by the presence of a carbon impurity in the tungsten filaments. (auth)

27800 (TID-17136) CONTRIBUTION TO THE PHASE DIAGRAM CALCIUM–ZINC. A. F. Messing, M. D. Adams, and R. K. Steunenberg (Argonne National Lab., Ill.). Aug. 1962. Contract W-31-109-38. 18p. (UAC-6753)

The phase diagram of the calcium–zinc system was re-examined by means of differential thermal analysis supplemented with x-ray diffraction and vapor effusion measurements. Evidence was found for the eight following compounds: Ca_5Zn_2, Ca_7Zn_4, CaZn, $CaZn_2$, Ca_7Zn_{20}, $CaZn_5$, $CaZn_{11}$, and $CaZn_{13}$. The compounds $CaZn_2$, $CaZn_5$, and $CaZn_{11}$ melt congruently at 704, 695, and 724°C, respectively. Incongruent melting is exhibited by Ca_5Zn_2, Ca_7Zn_4, CaZn, Ca_7Zn_{20}, and $CaZn_{13}$ at 394, 414, 439, 642, and 669°C, respectively. Crystal structure transformations are shown by Ca_5Zn_2 at 389°C and by CaZn at 414°C. Some observations were also made concerning the influence of hydrogen contamination on the allotropic transitions of calcium. (auth)

27801 (TID-17141) FERROMAGNETISM IN V–Fe AND Cr–Fe ALLOYS. M. V. Nevitt and A. T. Aldred (Argonne National Lab., Ill.). Aug. 7, 1962. Contract W-31-109-eng-38. 24p. (UAC-6755; ANL-FGF-374)

Saturation magnetizations of V–Fe and Cr–Fe alloys were measured and the results used to determine the average atomic magnetic moment. The linear rate of change of the moment with solute concentration was found to be −3.286 Bohr magnetons per atom in V–Fe α-phase alloys. Transformation of an approximately equiatomic alloy to the CsCl ordered α^1-phase resulted in a decrease of about 0.4 Bohr magneton in the moment. Subsequent transformation to the σ-phase lowered it by a factor of three. In Cr–Fe solid solution alloys, the rate of change of moment with solute concentration was found to be −2.36 Bohr magnetons per atom. (auth)

27802 (TID-18809) PHASE RELATIONSHIPS IN THE URANIUM–CARBON–OXYGEN SYSTEM. Robert F. Stoops and John V. Hamme (North Carolina State Coll., Raleigh). [1962]. Work Performed under United States–Euratom Joint Research and Development Program. Contract AT(40-1)-2663. 21p.

The U–C–O ternary system was investigated, and a diagram is given expressing the phase relationships in samples that were reacted at 1800°C in vacuums or inert atmospheres and furnace cooled. A U(C,O) single phase area exists in the diagram. The limit of substitutional solid solution of oxygen atoms for carbon atoms in UC is 12.5 at. % which means that only 25% of the carbon atoms in UC can be replaced by oxygen atoms. The oxygen saturated UC phase, $U(C_{0.75}O_{0.25})$, has a lattice parameter of 4.953 ± 0.001Å. The carbon monoxide partial pressures in equilibrium with the phase were determined for temperatures between 1705 and 1855°C. Cursory tests indicate that $U(C_{0.75}O_{0.25})$ may have significant advantages as a nuclear fuel material. (auth)

27803 (TID-18815) A SPECIMEN DESIGN FOR OBTAINING AVERAGE GROWTH INDICES IN URANIUM TUBES CONTAINING TEXTURE GRADIENTS. B. G. LeFevre and E. F. Sturcken (Du Pont de Nemours (E. I.) & Co. Savannah River Lab., Aiken, S. C.). [June 1963]. Contract AT(07-2)-1. 12p.

A composite x-ray sample is designed for measuring average growth indices for uranium tubes having texture gradients. The design takes into consideration: the texture gradient; different volume of U in different annuli of the tube; time that a given region of the sample spends in the x-ray beam as a function of the beam configuration and the distance of the given region from the center of the sample; change in beam width with 2θ; and the effect of scattering from the mounting material containing the pieces of the composite sample on the growth index. The composite sample design is employed to measure growth indices for five tubes of MK VB alloyed (Fe, Si, Al) uranium. (auth)

27804 (TID-18842) RESEARCH ON THE PROPERTIES OF MATERIALS AT LOW TEMPERATURES. Progress and Final Report, June 1, 1958 to May 31, 1962.

John C. Wheatley (Illinois. Univ., Urbana). May 1963. Contract AT(11-1)-1056. 7p.

Properties of liquid He^3 at cryogenic temperatures are discussed. Properties of concern are self-diffusion, specific heat, thermal conductivity, sound propagation, viscosity, expansion, magnetic properties, entropy, melting, solid-liquid behavior, and pressure. (N.W.R.)

27805 (TID-18859) RESEARCH ON STUDIES IN POINT DEFECT–DISLOCATION INTERACTIONS. Progress and Final Report, November 1, 1961 to October 31, 1962. H. K. Birnbaum (Illinois. Univ., Urbana). Apr. 1963. Contract AT(11-1)-1110. 12p.

Research progress made in the study of point defect-dislocation interactions is reported. The investigations discussed are analysis of strain-aging data for high-purity copper at 77 to 373°K, analysis of the effect of dislocation-point defect interactions on the Bordoni internal friction maxima in copper, design and construction of equipment for the measurement of internal friction and elastic moduli, and study of the vacancy-dislocation interactions by means of strain-aging studies subsequent to quenching. (N.W.R.)

27806 (TID-18876) DEFECTS IN ALUMINUM QUENCHED FROM THE LIQUID STATE. Technical Report No. 15. G. Thomas and R. H. Willens (California Inst. of Tech., Pasadena. W. M. Keck Lab. of Engineering Materials). May 1963. Contracts AT(04-3)-221 and Nonr-220(30). 16p.

High purity Al was quenched from the liquid state and specimens were examined by transmission electron microscopy. Very high densities of defects in the form of perfect loops, imperfect loops, and small black spots were observed. The vacancy concentration, as deduced from the number and size of defects, increased with increasing temperature at a much slower rate in the liquid than in the solid. Both the vacancy formation energy and the entropy factor appeared to be considerably reduced above the melting point. Also, a discontinuity in the vacancy concentration was observed at the melting point. (auth)

27807 (TID-18891) MATERIALS FOR HIGH TEMPERATURE NUCLEAR ENGINEERING APPLICATIONS. Quarterly Report No. 4, January 1, 1963 to April 1, 1963. J. D. Fleming, J. W. Johnson, Paul Boland, and S. H. Bomar (Georgia Inst. of Tech., Atlanta. Engineering Experiment Station). Apr. 1, 1963. Contract AT(40-1)-2483. 47p.

A treatment of the early cristobalite growth process in the firing of slip-cast fused silica predicted a cubic time variation in cristobalite. Analyses by x-ray diffraction yielded growth curves in agreement with this prediction. Based on these results, the initial cristobalite content of the fused silica slip is approximately 0.5%. Consideration of the conditions for maximum strengthening in fired slip-cast fused silica led to a functional analysis of the effects of firing temperature on the time required for maximum strengthening. The activation energy for this strengthening process, indicated by the analysis, is 205 kcal per mole. The study of sintering in slip-cast fused silica under one atmosphere of steam was completed. Application of the prediction of cubic time variation of cristobalite content to the steam-fired bars indicated an initial cristobalite content in the slip of 0.5%, in excellent agreement with the air data. The one-atmosphere-steam data were also used to determine the activation energy for devitrification in one-atmosphere steam. This activation energy is approximately 98 kcal per mole. Investigations were begun of firing slip-cast fused silica under two atmospheres of steam. The preliminary results of this study indicate sintering even more rapid than in one-atmosphere steam. The maximum moduli of rupture and firing time for maximum strength at 2100°F are approximately 4200 psi and 48 hours in one-atmosphere air, 4600 psi and 9.5 hours in one-atmosphere steam, and 6100 psi and 5 hours in two-atmosphere steam. Investigations were made of the influence of application of pressure and vibration during slip casting of fused silica. These studies showed that application of 60 psig lowered the casting time of $\frac{3}{4}$-in.-dia bars from 150 to 17 min at the cost of a decrease in cast bulk density from 1.854 to 1.846 g per cm^3. A 60-cps axial vibration of 0.015-in. amplitude increased the cast bulk density in 60 psig cast bars to 1.849 g per cm^3 without producing a noticeable increase in casting time. Modification and testing of the high-temperature x-ray-diffraction system were begun. Investigations were begun to determine the feasibility of measuring the aluminum conversion and reaction energy by differential thermal analysis (DTA) of reacting $Al-U_3O_8$ composites. Although trends were observed, quantitative comparisons were not possible due to complications, probably arising from uranium oxide stoichiometry changes, in the x-ray-diffraction analysis. Application of the DTA technique to calorimetry of reacting $Al-U_3O_8$ composites appears promising although only two samples were run. (auth)

27808 (UCRL-7030) THE STRUCTURES OF Ba_5Pb_3, BaPb, AND $BaPb_3$. Donald E. Sands, David H. Wood, and William J. Ramsey (California. Univ., Livermore. Lawrence Radiation Lab.). Aug. 14, 1962. Contract W-7405-eng-48. 24p.

The structures of the compounds Ba_5Pb_3, BaPb, and $BaPb_3$ were determined. Ba_5Pb_3 has the body-centered tetragonal $D8_e$ structure with $a = 9.038 \pm 0.010$, $c = 16.843 \pm 0.017$ Å; the space group is I4/mcm and there are four formula units per unit cell. The room temperature modification of BaPb has the orthorhombic B_f structure with $a = 5.29 \pm 0.01$, $b = 12.60 \pm 0.02$, $c = 4.78 \pm 0.01$ Å; the space group is Cmcm and there are four formula units per unit cell. $BaPb_3$ is rhombohedral with $a = 9.565 \pm 0.009$ Å, $\alpha = 44°47' \pm 3'$; the space group is $R\bar{3}m$ and there are three formula units per primitive cell. (auth)

27809 (UCRL-7284) SOME PHYSICAL, MECHANICAL, AND THERMODYNAMIC PROPERTIES OF TRANSITION METAL REFRACTORY CARBIDES. A Bibliography. Jean E. Senkin and M. Temple Milliken, comps. (California. Univ., Livermore. Lawrence Radiation Lab.). Mar. 1963. Contract W-7405-eng-48. 196p.

The mechanical, physical, and thermodynamic properties of the carbides of chromium, hafnium, molybdenum, niobium, tantalum, titanium, tungsten, vanadium, and zirconium are emphasized in the 1072 references. Listed with the references are a few previously prepared bibliographies on related fields. Information is included from 1880 to 1963. The references are arranged in alphabetical order by author. A subject index follows the references. (N.W.R.)

27810 (UCRL-10788) IMPACT OF DISLOCATION THEORY ON ENGINEERING. John E. Dorn (California. Univ., Berkeley. Lawrence Radiation Lab.). May 1963. Contract W-7405-eng-48. 49p.

Discussions concerning the values of dislocation theory to engineers are presented. Information is included on the nature of dislocations, stress fields and dislocation energies, dislocation mechanisms, athermal processes, thermally activated mechanisms, and plastic waves. (J.R.D.)

27811 (UNC-1004) CHARACTERIZATION OF URANIUM DIOXIDE POWDERS. Final Report. James F. Carpenter, Carl W. Kuhlman, and Robert A. Nelson (United

Nuclear Corp. Chemicals Div., Hematite, Mo.). [nd]. Contract AT(40-1)-2699. 79p.

The physical and chemical properties of uranium dioxide powders are correlated with ceramic activity of the pellets. The following properties are investigated: bulk and tap density, surface area, Fisher sub-sieve size, oxygen to uranium ratio, oxidation temperature, particle size determination of the raw oxide, and particle size determination on the pressed and repulped uranium dioxide powder. The properties show a general correlation with sinterability. The test results of particle size determination by sedimentation analysis on pressed and repulped oxides are the most consistent in predicting the final sintered density. (N.W.R.)

27812 (WADD-TR-61-134(Pt.II)) RESEARCH ON WORKABLE REFRACTORY ALLOYS OF TUNGSTEN, TANTALUM, MOLYBDENUM, AND COLUMBIUM. R. C. Westgren, V. R. Thompson, and V. C. Petersen (Crucible Steel Co. of America, Pittsburgh). Mar. 1, 1963. Contract AF33(616)-8135. 98p.

The W–Ta–Mo–Nb alloy system was previously investigated, and several tungsten- and tantalum-rich alloys were developed and evaluated in the form of extruded bars. Many of these alloys exhibited very high strengths at 3000°F; in fact, the tensile strengths of some alloys were in excess of 60,000 psi. A continuation was made of this effort, aimed at producing and evaluating alloys from the W–Ta–Mo–Nb system in the form of sheet and increasing the high-temperature strength of alloys of this type by the formation of dispersed carbides. Small cylindrical ingots of six selected W–Ta–Mo–Nb alloys and unalloyed tungsten were consumably vacuum arc-melted by a multiple electrode technique and successfully extruded to sheet bars. Two alloys and unalloyed tungsten were rolled to sheet and recrystallization temperatures, bend transition temperatures, and high-temperature tensile properties were determined. The other four alloys could not be rolled to sheet by the techniques attempted in this program. A technique for consumably vacuum arc melting 88W–12Nb alloys that contain small amounts of vanadium, zirconium, and carbon was developed. In the as-extruded condition, the alloys showed 3500°F tensile strengths of 49,000 to 57,000 psi—this constituted a twofold increase in strength above that of the base solid solution composition. (auth)

27813 (WCAP-3713) SOME PHYSICOCHEMICAL STUDIES OF BORIC ACID SOLUTIONS AT HIGH TEMPERATURES. D. E. Byrnes (Westinghouse Electric Corp. Atomic Power Div., Pittsburgh). Sept. 1962. Contract AT(30-1)-3064. 93p.

The use of a neutron absorber dissolved in the coolant has been proposed as a means of long-term control in large, closed-cycle water reactors, the so-called chemical shim. Boron appears among the most promising candidates, being added as boric acid in this particular control application. It is often found advantageous to add a second substance to the coolant, a pH-control agent. Benefits follow with respect to the corrosion behavior of the system. The agent proposed is an alkali, lithium or potassium hydroxide. Thus, it becomes of interest to examine the interactions of the two solutes, boric acid and alkali, at high temperatures. This has been done in the present investigation for two properties: boron volatility and electrical conductance. The former is of interest from physics and systems viewpoints, the latter because of its implications for purification. Detailed examination has been made of the nature of solutions of boric acid with and without added alkali. A mathematical treatment is presented which is capable of giving an approximate representation of the constitution of such solutions at room temperature. Detailed calculations have been made of the concentrations of the various species present as a function of total boron concentration. An experimental study has been made of the volatility of boron from such solutions at various concentrations and temperatures. From the results, it has been possible to deduce values for the stability constant of complex boron species at high temperatures. These values have then been used to produce curves depicting the variation in the disposition of boron among its species at high temperature. The high-temperature electrical conductances of solutions of boric acid, of alkalis, and their mixtures have been determined at a single (or zero) concentration of added alkali. The results have been linked qualitatively with those of the preceding portions of the work. (auth)

27814 (EURAEC-103) IMPROVEMENT OF URANIUM OXIDE SINTERING WITH A VIEW TO INCREASING ITS THERMAL CONDUCTIVITY. J. Peyssou, P. Hirtz (Compagnie Générale de Télégraphie sans Fil, Paris); R. Hauser, and S. Ezran (Compagnie Industrielle des Combustibles Atomiques Frittés, Corbeville, par Orsay (Seine-et-Oise), France). Mar. 1962. Work Performed under United States–Euratom Joint Research and Development Program. Contract 004-60-3-RDF. 32p. (A translation).

Studies were made on the possibility of improving the thermal conductivity of uranium oxide by the introduction of additives to enhance sinterability. The additives studied were the oxides of Ce, La, Y, Nb, Ca, and Ba for concentrations lower than 2 mol %. In the out-of-pile tests that were carried out, the first four additives provided, for a concentration of ¼%, results that were encouraging and that no doubt can be improved upon. The conditions for preparing, measuring, and checking the samples as well as additional physical measurements that enable the action of the additive to be characterized are specified. A considerable part of the work is devoted to a study of the microstructure. (P.C.H.)

27815 (NP-tr-1027) DETERMINATION OF LATTICE CONSTANTS BY X-RAY DIFFRACTOMETER. LATTICE CONSTANTS OF UC AND UC_2. I. Higashi. Translated by S. G. Brickley (U.K.A.E.A. Atomic Energy Research Establishment, Harwell, Berks, Eng.) from Rika Gaku Kenkyusho Hokoku, 37: 271-5(1961). 21p.

Lattice constants of UC and UC_2 were measured by the use of an x-ray diffractometer under optical system adjustments of the same order as for the identification of samples. It was confirmed that it is possible to carry out determinations within limits of ±0.0002 Å standard deviation with UC and 0.002 Å for a_0 and 0.004 Å for c_0 with UC_2. Values of the lattice constants are tabulated. (P.C.H.)

27816 (UCRL-Trans-921) $PdTe_2$—A SUPERCONDUCTOR WITH CdI_2 STRUCTURE. J. Guggenheim, F. Hulliger, and J. Mueller. Translated by Sergey Shewchuck (Univ. of California Lawrence Radiation Lab., Livermore) from Helv. Phys. Acta, 34: 408-10(1961). 5p.

The ditellurides of Pd, Ni, Rh, and Pt were examined. $PdTe_2$ was found to have a melting point of about 730°C; a resistance that decreased roughly linearly from room temperature up to 84°C, and an electron concentration of 3×10^{22} cm^{-3}. The temperature for transition to superconductivity was established at 1.7°K, and $PdTe_2$ was found to retain CdI_2-structure at low temperatures. The other three ditellurides (also of CdI_2-structure) have melting points above 1000°C and showed no superconductivity at temperatures of 1 and 1.2°K. Mixed crystals of $PdTe_2$ with

these compounds showed transition points ranging from 1.3 to 1.71°K, and no reason was found for excluding superconductivity in $NiTe_2$ and $PtTe_2$ at lower temperatures than were used. PdSeTe also displayed CdI_2 structure, but showed no superconductivity at 1.2°K. (D.C.W.)

27817 A LIGAND FIELD INVESTIGATION OF THE ZIRCONIUM–OXYGEN SYSTEM. Stig Flodmark and Bjorn Roos (Univ. of Stockholm). Acta Chem. Scand., 17: 859-60(1963). (In English)

A theoretical investigation of the lattice parameters, ionization, oxygen sorption in interstices, and cohesive energy of the lattice of the zirconium-oxygen system is discussed. A ligand-field model, where the overlap between the valence electrons of two different zirconium atoms is neglected, and the oxygen atoms are treated as point charges, is used. (N.W.R.)

27818 THE STRUCTURE OF THE σ-PHASE Co_2Mo_3. J. B. Forsyth and L. M. d'Alte da Veiga (Cambridge Univ., Eng.). Acta Cryst., 16: 509-12(June 10, 1963). (In English)

The σ-phase structure of Co_2Mo_3 was confirmed by single-crystal measurements. The structure was refined and the interatomic distances compared with those in Co_7Mo_6 and three other α-phases. The distribution of atoms in the available sites was determined: cobalt occupies the 12-fold, molybdenum the 15-fold, and a mixture of Co and Mo the 14-fold co-ordinated positions. (auth)

27819 X-RAY DETERMINATION OF THE ATOMIC POSITIONS IN α-URANIUM AT 22°C AND 600°C. W. T. Eeles (Central Electricity Generating Board, London and Northampton Coll., London). Acta Cryst., 16: 575(June 10, 1963).

X-ray diffraction photographs were made on high-purity α-uranium powder. The resulting values of the y coordinate are 0.1021 at 22°C and 0.1071 at 597 ± 4°C. The 22°C value agrees satisfactorily with previous values, while the 600°C value is closer to Mueller's value than to other values. Possible errors in the measurements are discussed. (D.L.C.)

27820 ETTINGSHAUSEN COOLING IN PYROLYTIC GRAPHITE. D. A. Wright (Dept. of Applied Physics, Science Labs., Durham, Eng.). Brit. J. Appl. Phys., 14: 329-34(June 1963).

The known properties of natural graphite suggest that it is one of the few materials that might give appreciable Ettingshausen cooling at low temperatures. It is difficult to obtain specimens of natural graphite suitable for measurement, but pyrolytic graphite can be prepared with many properties resembling those of natural crystals. An attempt to predict the performance at high magnetic fields from those properties that are already known is presented. It is concluded that good pyrolytic graphite as deposited should give a cooling that is appreciable, but not useful, even at very high fields. A heat treatment that gives quasi-single-crystal electrical properties should result in material in which electron-diffusion processes would give useful cooling below 15°K, but not higher. A very approximate treatment suggests, however, that phonon drag may lead to appreciable cooling in natural graphite between 15 and perhaps 50°K, though it is doubtful whether the cooling produced would be really useful. The reheated pyrolytic graphite is not likely to give phonon-drag effects as large as in natural single crystals. (auth)

27821 THE PERMEABILITY OF SILVER TO OXYGEN. R. E. Coles (Atomic Weapons Research Establishment, Aldermaston, Berks, Eng.). Brit. J. Appl. Phys., 14: 342-4(June 1963.

Some results on the dependence of the permeability Q of silver to oxygen on temperature T°K in the range 500 to 850°C, and on oxygen pressure P in the range 120 to 2050 torr, are given. It is found that $Q \propto P^{0.46}$ and $\log Q = 0.3244 - 5035/T (T < 630°C)$, $\log Q = -2.108 - 2841/T (T > 630°C)$. Using a silver capillary 4 ft long, 1 mm in outside diameter and of 0.005 in. wall thickness as a controllable gas leak for ion sources, etc., an estimate of the life of such a device is given, together with its cost. (auth)

27822 CREEP OF ZIRCALOY-2 PRESSURE TUBES. L. G. Bell. Can. Met. Quart., 2: 119-142(Apr.-June 1963).

The Zircaloy-2 pressure tubes of NPD-2 and CANDU reactors are to operate under conditions of stress, temperature, and a high neutron flux. A description is given of the creep test program carried out on transverse and longitudinal specimens from the tubes to determine the variation in creep properties with stress and temperature. At operating conditions, the minimum creep rate was found to be less than 6×10^{-6}%/hour and the estimated deformation in 30 years less than 0.3%. Transverse specimens failed erratically at high stresses because of unstable necking, but this is not expected to be a problem when the material is in the configuration of a tube. (auth)

27823 SOME PROPERTIES OF PLAIN CARBON STEELS CONTAINING URANIUM. G. P. Contractor (Dept. of Mines and Technical Surveys, Ottawa). Can. Mining Met. Bull., 56: 199-208(1963); Trans. Can. Inst. Mining Met., 66: 113-22(1963).

Medium and low C steels, modified with U, were studied in order to evaluate the influence of U on forgeability, mechanical properties, response to heat treatment, and microstructure. Uranium contents ranged up to 0.70%. The medium C steels are hot short if the U content exceeds about 0.35%. More U can be tolerated in low C steels. The hot shortness is caused by the formation of intergranular phase UFe_2. Critical transformation temperatures, Jominy hardenability, and resistance to tempering were not significantly affected by the presence of U. Similarly, U had little or no effect on the tensile properties of C steels. The addition of U has a favorable effect on the stress-rupture characteristics and some beneficial effect on fatigue properties. In the steels investigated, it seemed that most of the uranium carbide combined to form complex inclusions of U (O, C, N) or U (C, N), rich in O or N or both. Above 0.35% U, uranium carbide is believed to occur as discrete spheroidal or dot particles, which are stable at heat treating temperatures. (auth)

27824 KINETIC STUDY OF THE TRANSFORMATION OF THE RETAINED β PHASE BY TEMPERING FROM THE $\beta + \gamma_1$ RANGE IN THE URANIUM–NIOBIUM ALLOY WITH 2.5 AT. % Nb. Claude Collot and Rene Faivre (Faculte des Sciences et E.N.S.M.I.M., Nancy and CEA, Saclay, France). Compt. Rend., 256: 3856-9(Apr. 29, 1963). (In French)

Low inertia isothermal dilatometry was used to determine the curves for the beginning and end of the transformation of the retained β phase by tempering from the $\beta + \gamma_1$ range in the U–Nb alloy with 2.5 at.% Nb. The kinetics of this transformation were studied. The activation energy of the transformation is estimated to be about 14,500 cal/mol. (tr-auth)

27825 PHASE DIAGRAMS FOR THE SYSTEMS CHROMIUM–NIOBIUM AND CHROMIUM–NIOBIUM–NICKEL. V. N. Svechnikov and V. M. Pan. Issled. po

Zharoproch. Splavam, Akad. Nauk SSSR, Inst. Met., 8: 47-56(1962).

The Cr–Nb, quasibinary $NbCr_2$–Ni_3Nb, and Cr–Nb–Ni systems were studied in detail by differential thermal analysis x-ray diffraction. The phase diagrams derived are given. The Cr–Nb alloy containing 47.18% Nb was found to undergo an allotropic transformation at 1590°C, and to have a mp of 1720°C; the allotropic transformation is associated with a transition from a low temperature β structure of the $MgCu_2$ type to a high-temperature one (ϵ) of the $MgZn_2$ type with lattice parameters a = 4.92 and c = 8.10 kX. In the system Nb–Cr, a eutectoid transformation ($\epsilon \rightleftharpoons \alpha + \beta$) occurs at 1585°C in Cr-rich alloys, while a peritectoid transformation takes place at 1625°C in Nb-rich alloys. The addition of >5-6% Ni to the $NbCr_2$, with tempering at 1100°C, causes the formation of a new phase that is assumed to consist of a solid solution of Ni in the ϵ-modification of $NbCr_2$; the solubility of Ni in the ϵ-phase is 36% at 1100°. A four-phase peritectoid equilibrium $\gamma + \epsilon \rightleftharpoons \alpha + \delta$ (where δ is Ni_3Nb) exists at 1160°C in the Cr–Ni–Nb diagram, in the section confined within the Cr–Ni–Ni_3Nb–$NbCr_2$ quadrangle; the composition of the peritectoid point is: 30.0% Cr, 23.5% Nb, 46.5% Ni. This quadrangle contains one quasibinary section only, namely, the $NbCr_2$–Ni_3Nb one. (OTS)

27826 A STUDY OF CHROMIUM–NIOBIUM–TITANIUM ALLOYS. V. N. Svechnikov, Yu. A. Kocherzhinskii, V. I. Latysheva, and V. M. Pan. Issled. po Zharoproch. Splavam, Akad. Nauk SSSR, Inst. Met., 8: 56-61 (1962).

A systematic study was made on Cr-based alloys containing up to 47.5% Nb and 37.5% Ti, and Nb-based alloys containing up to 30% Cr and 30% Ti. The isothermal sections at 1250 and 1380°C are presented. In the Cr-rich corner (above 60% Cr) there are three one-phase regions (α-solid solution based on Cr, β-solid solution based on $NbCr_2$, and γ-solid solution based on $TiCr_2$), three two-phase regions ($\alpha + \beta$, $\alpha + \gamma$, $\beta + \gamma$) and one three-phase region ($\alpha + \beta + \gamma$) at 1250°C; at 1380° only α, β, and $\alpha + \beta$ exist and a liquid phase (composition 25 to 35% Ti, 5 to 15% Nb) is observed. In the Nb-rich corner (above 70% Nb) there are a single phase region δ (Nb-based solid solution) and a two-phase region $\beta + \delta$; the δ region is enlarged on heating to 1380° but both regions exist at 1250 and 1380°C. Although some of the alloys in the system studied are characterized by a high hardness (H_T = 1187 kg/m^2 for the alloy containing 30% Cr, 70% Nb at 600°C), and others are characterized by high resistance to scale formation at high temperatures (the alloy containing 25% Cr, 5% Ti), there are no alloys that have both properties simultaneously. (OTS)

27827 A STUDY OF THE INTERACTION BETWEEN THE INTERMETALLIC COMPOUNDS Ni_3Al AND Ni_3Nb. R. S. Mints, G. F. Belyaeva, and Yu. S. Malkov. Issled. po Zharoproch. Splavam, Akad. Nauk SSSR, Inst. Met., 8: 79-84(1962).

Thermal, metallographic, and x-ray diffraction analysis, and hardness and electric resistivity measurements were used to study the interaction between Ni_3Al and Ni_3Nb. The stoichiometric composition Ni_3Al crystallizes at 1390 to 1400°; alloys containing less than 40% Ni_3Nb are composed of a single phase, a Ni_3Al–based solid solution. Alloys containing >40% Ni_3Nb (except pure Ni_3Nb) show the presence of two different crystalline lattices–a fcc one (Ni_3Al-based solid solution, a = 3.562 Å in the case of pure Ni_3Al), and a rhombic one (Ni_3Nb-based solid solution, a = 5.090, b = 4.234, c = 4.524 Å in the case of pure Ni_3Nb). The eutectic composition is 30% Ni_3Al, 70% Ni_3Nb, crystallization temperature = 1280°. Both the electric resistivity (ρ) and the hardness (H_V) increase with increasing Ni_3Nb to a certain maximum, and decrease if further amounts of Ni_3Nb are added; the maximum values are: ohm.cm × 10^8 for the alloy containing 35 to 45% Ni_3Nb (the single phase alloy at the limit of solubility of the Ni_3Nb); of H_V –444 kg/mm^2 for the alloy containing 50% Ni_3Nb after tempering at 1100° and annealing (the two-phase alloy with a minimum amount of the second phase). Photomicrographs showing the microstructure of the various alloys are presented. (TCO)

27828 AN X-RAY INVESTIGATION OF THE CRYSTALLINE STRUCTURE OF ALLOYS IN THE SYSTEM Ni_3Al–Ni_3Nb. M. P. Arbuzov and V. G. Chuprina. Issled. po Zharoproch. Splavam, Akad. Nauk SSSR, Inst. Met., 8: 85-7(1962).

The structure of Ni_3Al, Ni_3Nb, and various Ni_3Al–Ni_3Nb alloys was studied by the powder method using the Fe radiation, in a Debye camera 57.3 mm in diameter. The Ni_3Al composition has an fcc lattice, with a lattice constant a = 3.562 Å; superlattice lines indicate an ordered structure. The Ni_3Nb composition has a rhombic lattice, with lattice constants a = 5.090, b = 4.234, c = 4.524 Å; and an ordered structure is indicated by superlattice lines. Alloys containing 10 to 40% Ni_3Nb are composed of one phase only, with a structure similar to that of Ni_3Al; the lattice constant, however, increases with increasing Ni_3Nb content, to a = 3.592 Å for the alloy containing 40% Ni_3Nb. Alloys containing 50 to 90% Ni_3Nb are composed of two phases–one with an fcc and another with a rhombic lattice. The lattice constants are: for the fcc a = 3.593 Å, for the rhombic a = 5.103 Å, b = 4.436, c = 4.533 Å; the values are independent of the composition, within the range mentioned. The alloys have an ordered structure, and it is evident that their constituents are a solid solution based on Ni_3Al and a solid solution based on Ni_3Nb. X-ray diagrams for the various alloys are presented. (OTS)

27829 DENSITY STUDIES OF HIGH-MELTING METAL POWDER COMPACTS. F. M. Alekseeva, R. S. Matyushenko, V. S. Rakovskii, and A. F. Silaev. Izv. Akad. Nauk SSSR, Otd. Tekhn. Nauk, Met. i Gorn. Delo, No. 2, 100-3 (Mar.-Apr. 1963). (In Russian)

An x-ray analysis was made of Cr, Mo, Nb, and W powders compressed at 2 to 8 t/cm^2. Identical density regularities were observed in the specimens with microdensity growth at 4 to 6 t/cm^2. Constitution diagrams indicated a variability in microdensities as a function of specific compression. (R.V.J.)

27830 AN INVESTIGATION OF ALPHA AND BETA TITANIUM–ZIRCONIUM CREEP PROPERTIES. K. A. Osipov, E. M. Miroshkina, and A. L. Sotnichenko (Baikov Metallurgical Inst., USSR). Izv. Akad. Nauk SSSR, Otd. Tekhn. Nauk, Met. i Gorn. Delo, No. 2, 146-52(Mar.-Apr. 1963). (In Russian)

An analysis was made of creep properties of α and β Ti–Zr alloys at constant applied tensions of 30 to 70 kg/mm^2 at room temperature to 200°C. (R.V.J.)

27831 DETERMINATION OF ELECTRON AND HOLE MOBILITY RATIO IN InSb BY MEANS OF N–E THERMOMAGNETIC EFFECTS. K. T. Basova (Moscow Inst. of Engineering Physics). Izv. Vysshikh Uchebn, Zavedenii, Fiz., No. 2, 19-23(1963). (In Russian)

The ratio of electron and hole mobilities in InSb specimens was measured on the basis of transverse and longitudinal thermodynamic Nernst-Ettinghauser effect. The ratio of the motion is a function of magnetic field. (tr-auth)

27832 PREPARATION AND PROPERTIES OF URANIUM AND THORIUM MONOSULFIDES. P. D. Shalek (Argonne National Lab., Ill.). J. Am. Ceram. Soc., 46: 155-61(Apr. 21, 1963).

Uranium and thorium monosulfide bodies were made by the reaction of H_2S with the metal at low temperatures followed by homogenization and sintering at high temperatures. Some US–ThS solid solutions also were made. The effect of homogenization and firing temperature, S/metal ratio, impurities, and atmosphere on the densification, structure, and properties of these bodies is discussed. The properties evaluated include melting point, electrical resistivity, thermal conductivity, thermal expansion, hardness, strength, oxidation behavior, and compatibility. (auth)

27833 PHASE STUDIES IN BeO–METAL OXIDE SYSTEMS USING A POROUS-COLLECTOR TECHNIQUE. A. T. Chapman (Oak Ridge National Lab., Tenn.). J. Am. Ceram. Soc., 46: 171-4(Apr. 21, 1963).

The phase relations in high-temperature BeO–metal oxide systems were investigated by means of a porous-collector technique. In this technique, which was found to be applicable to simple eutectic oxide systems with fluid melts, the liquid formed during heating of a wafer-shaped specimen was absorbed in a porous collector. The lowest temperature at which the liquid formed and the material balance were used to establish the eutectic temperature and composition. The eutectics in four binary systems were determined as (1) ZrO_2–BeO, 2045 ± 10°C, 59 ± 2 mole % BeO, (2) CeO_2–BeO, 1890 ± 20°C, 63 ± 3 mole % BeO, (3) MgO–BeO, 1860 ± 10°C, 69 ± 2 mole % BeO, and (4) MgO–ZrO_2, 2080 ± 10°C, 65 ± 3 mole % MgO. Experiments in the ternary system MgO–ZrO_2–BeO indicated an extensive region of solid solubility in the ZrO_2-rich portion of the system and a eutectic plane at 1720 ± 10°C. (auth)

27834 PHASE STUDIES IN THE BINARY SYSTEM MgO–Ta_2O_5. Y. Baskin and D. C. Schell (Argonne National Lab., Ill. and Illinois Inst. of Tech., Chicago). J. Am. Ceram. Soc., 46: 174-7(Apr. 21, 1963). (ANL-FGF-373)

The objective of this investigation was to determine subsolidus phase relations in the system MgO–Ta_2O_5 and to obtain accurate crystallographic data on the compounds formed. MgO and Ta_2O_5 formed three compounds: $Mg_4Ta_2O_9$, $Mg_3Ta_2O_8$, and $MgTa_2O_6$. $Mg_4Ta_2O_9$ and $MgTa_2O_6$ appeared to be stable up to their melting points, whereas $Mg_3Ta_2O_8$ was stable only between 1475 and about 1675°C. X-ray diffraction and density data are presented for the three compounds. (auth)

27835 EVIDENCE FOR HIGH-TEMPERATURE FORMS OF ZIRCONIUM AND TANTALUM MONOCARBIDES. Peter T. B. Shaffer (Carborundum Co., Niagara Falls, N. Y.). J. Am. Ceram. Soc., 46: 177-9(Apr. 21, 1963).

Evidence was found which suggests the existence of high-temperature crystalline modifications of both zirconium carbide and tantalum carbide. The high-temperature inversion in zirconium carbide, indicated by a sharp decrease in spectral emissivity, in electrical resistivity, and in density, was reversible. No permanent changes in microhardness or in x-ray diffraction patterns were found after cooling to room temperature. Emissivity measurements showed a hysteresis effect of approximately 400°C for zirconium carbide. A similar, although less sharply defined, effect was noted for tantalum carbide. No such effect was found in solid solutions of these two monocarbides. (auth)

27836 THE SYSTEM PuO_2–ZrO_2. D. F. Carroll (General Electric Co., Richland, Wash.). J. Am. Ceram. Soc., 46: 194-5(Apr. 21, 1963). (HW-SA-2829)

A phase diagram study of the PuO_2–ZrO_2 system was conducted. A single-phase face-centered cubic solid solution was found from pure PuO_2 to 77 mole % ZrO_2, while the region from 77 to 99.8 mole % ZrO_2 contains two phases, monoclinic ZrO_2 and a face-centered cubic 77 mole % ZrO_2 solid solution. The liquidus and solidus points were found to be indistinguishable from each other. (D.L.C.)

27837 CRYSTAL STRUCTURE OF YTTRIUM AND OTHER RARE-EARTH BORATES. R. E. Newnham, M. J. Redman, and R. P. Santoro (Massachusetts Inst. of Tech., Cambridge). J. Am. Ceram. Soc., 46: 253-64(June 1963).

The crystal structures of YBO_3 and several isomorphous rare-earth borates were determined from x-ray diffraction powder patterns. The unit cell is hexagonal with the borate groups parallel to c, and each rare-earth ion is coordinated to a distorted cube of eight oxygens. Magnetic-susceptibility measurements on $ErBO_3$ show only slight deviations from ideal paramagnetic behavior at low temperatures. (auth)

27838 HIGH-TEMPERATURE THERMOPHYSICAL PROPERTIES OF URANIUM MONOCARBIDE. L. N. Grossman (General Electric Co., Pleasanton, Calif.). J. Am. Ceram. Soc., 46: 264-7(June 1963).

Thermal conductivity (k), electrical resistivity (ρ), total hemispherical emittance (ϵ_t), and normal spectral emittance ($\epsilon_{0.65\mu}$) of dense, arc-cast uranium monocarbide (5.3 wt % total carbon) were measured in the temperature range 1150 to 2050°K. The results were as follows: k, 0.057 cal/sec-cm-deg, $1200 < T < 2050$°K, probable error ±0.002; ρ, $20.4 \times 10^{-6} + 114.8T \times 10^{-9}$ ohm-cm, $1175 < T < 2050$°K, probable error $\pm 1.7 \times 10^{-6}$; ϵ_t, 0.42, $1250 < T < 1980$°K, probable error ±0.02; $\epsilon_{0.65}$, $0.539 - 0.02T \times 10^{-3}$, $1150 < T < 1890$°K, probably error ±0.02. Experimental methods are discussed and error sources are analyzed. Uranium monocarbide exhibited typical metallic behavior in its thermophysical properties. (auth)

27839 DEFORMATION AND FRACTURE OF POLYCRYSTALLINE LITHIUM FLUORIDE. William D. Scott and Joseph A. Pask (Univ. of California, Berkeley). J. Am. Ceram. Soc., 46: 284-93(June 1963). (UCRL-10435)

Techniques for the fabrication of polycrystalline LiF test specimens were developed and evaluated using single-crystal LiF as a control. An etch was developed which revealed dislocations on all crystallographic faces of LiF. Large-grained polycrystalline specimens tested in four-point loading underwent 0.076 to 0.798% plastic strain before fracture. In most cases their yield stress was similar to that for single crystals favorably oriented for flow on {110} (110) slip systems. Deformation was inhomogeneous among the grains because of differences in orientation with respect to the applied stress and within individual grains because of interactions at grain boundaries. Grain boundaries were barriers to slip, but stresses resulting from slip in one grain were transmitted to neighboring grains and often caused local deformation near the boundary. In one case, local boundary slip occurred on a (010) plane. Three-grain junctions were areas of high residual stresses, and fractures originated at boundaries at or near three-grain junctions. Fractures were mixed transgranular and intergranular. (auth)

27840 INFRARED ABSORPTION SPECTRA OF RARE-EARTH OXIDES IN THE REGION 800 to 240 Cm^{-1}. William L. Baun and Neil T. McDevitt. (Air Force Materials Lab., Wright Patterson AFB, Ohio). J. Am. Ceram. Soc., 46: 294(June 1963).

Rare earth oxides give individualistic infrared spectra in the intermediate region 800 to 240 cm^{-1}. Spectra of all

type C (cubic) are similar with each other, with a band occurring at 535 to 570 cm^{-1}, while type A (hexagonal) and type B (monoclinic) give spectra much different from those of type C. Characteristic frequencies are tabulated for the oxides of type C and for other rare earth oxides. (D.L.C.)

27841 COMMENTS ON THE ARTICLE "DIFFUSION IN COBALT–NICKEL ALLOYS." Richard J. Borg (Univ. of California, Livermore). J. Appl. Phys., 34: 1562-3 (May 1963). (UCRL-7139-T)

The magnetic effect on atomic diffusion is discussed briefly. The results of Hirano et al. on the diffusion of Co and Ni in pure Co and several Co–Ni alloys (ibid., 33: 3049) were examined and found to contradict their claims. For the diffusion of Co into pure Co, if all the data points for the ferro- and paramagnetic regions are treated together rather than separately, one diffusion equation is obtained. Further, in the case of the magnetic effect found in some Co–Ni alloys, the effect actually decreases with the Curie temperature, and the data do not support the vacancy decrease model. (D.L.C.)

27842 EXPERIMENTAL VERIFICATION OF THEORIES ON DISLOCATION BEHAVIOUR OF STRAINED F.C.C. METALS. D. Kuhlmann-Wilsdorf (Univ. of Pennsylvania, Philadelphia), H. J. Levinstein, W. H. Robinson, and H. G. F. Wilsdorf. J. Australian Inst. Metals, 8: 102-14 (May 1963).

In a recent investigation, based on a high-resolution etch-pitting technique, the dislocation distribution in strained silver single crystals was examined. Several new results of considerable interest were obtained. A careful analysis and comparison of these, and of previous results, shows them to disprove theories on the phenomenon of dislocation tangling which are built on the assumption that either cross-slip or dislocation intersections are the decisive mechanism. Also discredited are theories of work-hardening based on dislocation jogs or long-range stresses as responsible for the greater part of work-hardening in stage II. By contrast, the basic hypotheses and major conclusions of the theory of "mushrooming", and the theory of work-hardening by one of the authors (D.K.W.), are in striking agreement with all the results. This is interpreted as constituting a virtual proof of the basic framework of these theories. (auth)

27843 MODEL FOR THE ELECTRONIC STRUCTURE OF METAL TUNGSTEN BRONZES. A. R. Mackintosh (Ames Lab., Ames, Iowa). J. Chem. Phys., 38: 1991-8 (Apr. 15, 1963). (IS-529)

The electronic properties of the metal tungsten bronzes of high x value are interpreted in terms of a model in which the conduction electron wavefunctions are derived principally from the metal atomic p functions. It is shown that the physical properties of the bronzes are consistent with this model, which is compared, in this respect, with others. The transition to metallic conductivity at low x values is discussed, using the theory of Mott, and a number of experiments are suggested for clarifying some features of the electronic structure of the tungsten bronzes, and also of the related vanadium bronzes. (auth)

27844 THE DIFFUSION COEFFICIENTS FOR HYDROGEN IN β-ZIRCONIUM. V. L. Gelezunas (General Electric Co., Cincinnati), P. K. Conn, and R. H. Price. J. Electrochem. Soc., 110: 799-805(July 1963).

The diffusion coefficients of hydrogen in β-zirconium were calculated from experimental hydrogen sorption curves. The results were D (cm^2/sec) = 5.32×10^{-3} exp (–8320/RT), (760 to 1010°C). This relationship was independent of hydrogen concentrations (to 41 at. % H) and oxygen concentrations (to 4.2 at. % O) in β-zirconium. Oxygen in solid solution with zirconium and surface films on the zirconium reduced the rate of hydrogen sorption by zirconium. The effect of oxygen in solid solution with zirconium was observed to be related to the α to β transformation, while the effect of surface films was related to the hydrogen concentration at the film-zirconium interface. (auth)

27845 SECONDARY RECRYSTALLISATION IN MAGNOX AL 80. G. T. Higgins (Univ. of Liverpool). J. Nucl. Mater., 8: 153-9(Mar.-Apr. 1963). (In English)

Exaggerated grain growth observed in the magnesium canning alloy Magnox AL 80 (Al/0.8 wt %, Be/0.004 wt %) is typical of the phenomenon classified as Secondary Recrystallization. Studies on alloys of varying composition indicate that the presence of 40 ppm beryllium is of particular importance in promoting the effect. Metallographic observations indicate that both marked equilibrium segregation and precipitation occur at the grain boundaries of the fine-grained alloy. It is suggested that normal grain growth is restricted and the conditions for secondary recrystallization realized by the combined pinning action of the precipitates and equilibrium segregates. A rotation of $24\frac{1}{2}$ or $35\frac{1}{2}$° about the [0001] axis accompanies secondary recrystallization, but the exact role of texture in relation to the phenomenon has not been clearly defined. (auth)

27846 SOME OBSERVATIONS OF THE PICK-UP OF HYDROGEN IN MAGNOX ZR 55 AND ITS RELATION TO MECHANICAL PROPERTIES. G. T. Higgins and B. W. Pickles (United Kingdom Atomic Energy Authority, Culcheth, Lancs, Eng.). J. Nucl. Mater., 8: 160-8(Mar.-Apr. 1963). (In English)

A study was made of the influence of the hydrogen content of heat treatment atmospheres on the grain growth and hydrogen pick-up of ZR 55 at 475 and 600°C. Hydrogen analysis, electrical resistivity measurements, and metallographic observations showed that in air, hydrogen, and argon at 475°C and in saturated CO_2 (10 000 ppm of moisture) at 600°C, the available zirconium is rapidly converted to zirconium hydride. Grain growth is in all cases restricted by hydride formation, but particularly under conditions giving a fine hydride dispersion. The ductility at 200°C is substantially reduced by prior heat treatment at 475°C in hydrogen, while after treatment in saturated CO_2 only a slight loss of ductility, attributable to grain growth, occurs. Hydrogen pick-up during high temperature creep testing led to pronounced hardening in several cases and in one instance to embrittlement. Results are presented showing that fully hydrided materials have a good low temperature ductility, with a grain size stability superior to that of normal ZR 55. (auth)

27847 THE FATIGUE BEHAVIOUR OF MAGNESIUM-ZIRCONIUM AND MAGNESIUM–ALUMINUM CANNING MATERIALS. R. Doldon (United Kingdom Atomic Energy Authority, Culcheth, Lancs, Eng.). J. Nucl. Mater., 8: 169-78(Mar.-Apr. 1963). (In English)

Fatigue tests were carried out on two magnesium alloys, one containing 0.8% Al and the other 0.55% Zr. The alloy containing zirconium will withstand approximately twice the stress required to cause failure in a given number of cycles in the aluminium alloy. The endurance of both alloys is reduced at any stress by lowering the frequency of stress alternation. (auth)

27848 THE DEVELOPMENT OF METALLURGICALLY STABLE MAGNESIUM–ZIRCONIUM ALLOYS WITH HIGH

CREEP DUCTILITY. E. A. Walker and P. A. Fisher (Magnesium Elektron Ltd., Manchester, Eng.). J. Nucl. Mater., 8: 179-86(Mar. -Apr. 1963). (In English)

The creep ductility of ZA (Mg–0.6 wt % Zr) at 200°C can be improved considerably by heat treatment in hydrogen at 550°C prior to working. The treatment produces a metallurgically stable alloy with at least as good resistance to creep at 400°C as conventional ZA with enhanced resistance to grain growth. Similar hydriding treatments applied after working result in coarse-grained alloys with poor creep ductility at 200°C. (auth)

27849 THE CREEP BEHAVIOUR OF THE MAGNESIUM–ZIRCONIUM ALLOY ZA AT 400° AND 450°C IN CARBON DIOXIDE CONTAINING ≈200 PPM MOISTURE. R. P. Kent and T. C. Wells (International Research and Development Co. Ltd., Newcastle-upon-Tyne, Eng.). J. Nucl. Mater., 8: 198-206(Mar.-Apr. 1963). (In English)

The creep behavior of the magnesium-zirconium alloy ZA was studied in tests of up to 5600 hr duration at 400°C and up to 12 600 hr duration at 450°C, in an atmosphere of carbon dioxide containing ≈200 ppm water. The accompanying microstructural changes were observed by optical and electron microscopy. The alloy is stronger at 450°C than at 400°C and additional strengthening obtains from prestraining at 250°C prior to creep-testing. In stress rupture tests at 200°C subsequent to creep-testing, the time to rupture and the rupture ductility are lower in specimens previously tested at 450°C than in those tested at 400°C. The increase in creep strength at 450°C, and subsequent loss of ductility, are attributed principally to the precipitation of a zirconium-rich phase, tentatively identified as ϵ-zirconium hydride, which forms both intragranularly (as ribbons and thin hexagonal plates) and as intergranular particles. (auth)

27850 THE TEXTURE OF HOT-PRESSED BERYLLIUM OXIDE. J. W. Kelly (Australian Atomic Energy Commission, Lucas Heights, New South Wales). J. Nucl. Mater., 8: 227-31(Mar.-Apr. 1963). (AAEC/TM-152) (In English)

When beryllium oxide is hot-pressed above 1500°C, a weak basal plane texture develops with the normals to these planes aligning themselves at right angles to and randomly about the hot-pressing direction. The strength of the texture is pressure-dependent and texturing is accompanied by extensive grain growth. The effect is tentatively attributed to the anisotropic elastic properties of beryllium oxide. (auth)

27851 THE $\alpha \rightarrow \beta$ PHASE TRANSFORMATION IN URANIUM. I. F. Barwood and B. R. Butcher (Atomic Energy Research Establishment, Harwell, Berks, Eng.). J. Nucl. Mater., 8: 232-40(Mar.-Apr. 1963). (AERE-R-2148) (In English)

The kinetics of the $\alpha \rightarrow \beta$ phase transformation of two grades of uranium were studied by dilatometric methods. With pure uranium, it was shown that the transformation can proceed isothermally to completion only a few degrees above the α/β equilibrium temperature, although the last stages are very sluggish. If the transformation is allowed to go to completion, the preferred orientation is largely destroyed at the low β-phase temperatures. The mechanism of transformation is discussed. (auth)

27852 THE RESISTIVITY OF INTERSTITIAL ATOMS AND VACANCIES IN α–URANIUM. A. D. Brailsford (English Electric Co. Ltd., Whetstone, Eng.). J. Nucl. Mater., 8: 248-58(Mar.-Apr. 1963). (In English)

The contribution of interstitial atoms or vacancies to the electrical resistivity of α-uranium was studied. In both cases the resistivity was found to be mainly determined by the scattering of carriers off the distortion in the host matrix surrounding the defect, rather than by the excess charge of the defect itself. The estimated resistivity resulting from one atomic per cent of interstitial atoms is 71 $\mu\Omega$ cm. The corresponding value for vacancies is 28 $\mu\Omega$ cm. (auth)

27853 LATTICE PARAMETER AND HARDNESS MEASUREMENTS ON HIGH PURITY BERYLLIUM. K. J. H. Mackay (Tube Investments Research Labs., Cambridge, Eng.) and N. A. Hill. J. Nucl. Mater., 8: 263-4 (Mar.-Apr. 1963). (In English)

Lattice parameter determinations and hardness measurements on 99.9% purity beryllium are reported. The lattice parameter values at 20.5°C are $a_0 = 2.2858 \pm 0.0002$ and $c_0 = 3.5843 \pm 0.0003$ Å. The measured hardness of the distilled crystals ranged from 64 to 190 DPN (about a mean of 100 DPN) varying with the angle, α, of the long diagonal of the indenter, relative to the (1120) direction. A comprehensive series of hardness measurements on a single crystal of zone-refined cast Pechiney bar (~99% purity) gave a minimum value of 65 DPN for indentation into a prism plane, a mean value of 92 DPN. Therefore, the results show that purification does not significantly affect the hardness. (P.C.H.)

27854 A REMARK ON THE ANOMALY OF ELECTRIC RESISTANCE OF SINTERED UO_2. Baruch Raz and Hans-Eberhard Schmidt (Centre d'Etudes Nucléaires, Fontenay-aux-Roses, France). J. Nucl. Mater., 8: 265-7(Mar.-Apr. 1963). (In French)

A study of the electric conductivity of sintered UO_2 pellets showed that the conductivity decreased with the porosity of the sample and that it practically disappears at a relative density greater than 92% theoretical. The electric conductivity at ambient temperature diminished in air at an initial velocity of the order of 0.2%/hr, saturation being obtained after about 65 hr. From the results it was concluded that the conductivity anomaly can be attributed to gas absorption on the surface of the samples. (P.C.H.)

27855 EVIDENCE OF LATE GRAIN BOUNDARIES IN URANIUM–MOLYBDENUM ALLOYS OF LOW CONTENT. M. Bouleau and P. Pouyaud (CEN, Saclay, France and Service de Technologie, Gif-sur-Yvett, France). J. Nucl. Mater., 8: 273-4(Mar.-Apr. 1963). (In French)

Two methods used to obtain preferential evidence of the late grain boundaries in U-0.5-1.5% Mo alloys are presented. The first method involves very short electrolytic repolishing of the samples previously polished and attacked. The second polishing diminishes the anodic attack of the matrix (to lamellar structure) and causes the grain boundaries to stand out clearly. The second methods involves electrolytic attack after passivation of the polished surfaces. Thus the matrix (lamellar structure) is strongly colored while the borders corresponding to the traces of late grain boundaries appear in white. (P.C.H.)

27856 TERNARY $AlMnBe_4$ PHASES IN COMMERCIALLY PURE BERYLLIUM. J. A. Carrabine (Brush Beryllium Co., Cleveland). J. Nucl. Mater., 8: 278-80 (Mar.-Apr. 1963). (In English)

Studies were made on the fcc impurity phase in commercially pure Be. Particular attention was given to $AlMnBe_4$. Chemical analysis of the compound showed 22.9 wt % Al, 43.5 wt % Mn, and 28.7 wt % Be and corresponded to an empirical formula of $Al_{1.06}Mn_{0.98}Be_{3.96}$. The theoretical density of the compound was calculated to be 3.43 g/cm^3, and the actual density of the powder was measured pycnometrically as 3.33 g/cm^3. The results warrant the

conclusions that the fcc impurity observed in commercially pure Be is a ternary compound of the form $AlMBe_4$, where M is a transition metal. (P.C.H.)

27857 THE CONTRIBUTION TO THE COMPATIBILITY OF URANIUM–TITANIUM SYSTEM. Miroslav Holinka, Vladimir Masarik, and Eva Karnikova. Jaderna Energie, 9: 109-13(1963). (In Czech.)

Qualitative metallographic investigations of uranium and titanium diffusion with regard to UO_2 phase forming and behavior are described. A review of foreign literature concerning the U–Ti system is given, the experimental method used for material compatibility investigation is described, and the results and method of qualitative evaluation of diffusion progress are reported. (auth)

27858 ON THE SYSTEM U_3Si_2–UFe_2. H. Steinkopff and W. Huettig (Zentralinstitut für Kernphysik, Rossendorf, Ger.). Kernenergie, 6: 180(Apr. 1963). (In German)

Phase studies of the Fe–Si–U system are discussed. (M.C.G.)

27859 REFINEMENT OF Cr–Mo–V STEEL BY CERIUM. L. P. Trusov and V. I. Kumanin. Liteinoe Proizv., No. 4, 34-7(Apr. 1963).

The effect of Ce on the properties of a pearlitic heat-resistant steel for service at 580 and 240°C was investigated. Cerium was added as mischmetal (50% Ce, 25% La, 15% Nd, and 10% other rare earth metals) either in furnace or ladle. It was found that 0.20% Ce decreased the total S content, made the sulfide distribution more uniform, and reduced nonmetallic impurities by 30 to 45% and O content by more than 50%. For tests of mechanical properties, the steel was annealed at 1080 to 1100°C for 2 hr, aged at 740 to 750°C for 5 hr, and air-cooled. The addition of 0.20% Ce was found to increase the yield strength and tensile strength at 580°C from 38.2 to 41.5 to 42.1 kg/mm^2 and from 43.5 to 46 to 46.7 kg/mm^2, respectively. However, the highest notch toughness at room temperature, 13.2 to 16.2 kg/cm^2, was obtained at 0.50 to 0.10% Ce. Also, the longest rupture life, 1255 or 563 hrs, at 580°C under a stress of 20 kg/mm^2 was obtained with 0.05% Ce added in furnace or in ladle, respectively. In both cases the fracture was intergranular, while nonmodified steel had a transgranular fracture. The creep strength at 580°C and a creep rate of 10^{-5}% per hr were found to be 7 kg/mm^2, compared with 6 kg/mm^2 for the nonmodified steel. Oxidation resistance of the Ce-modified steels at 600, 650, and 700°C was found to be lower than that of the unmodified metal. (OTS)

27860 GASEOUS DIFFUSION IN POROUS MEDIA WITH PARTICULAR REFERENCE TO GRAPHITE. G. F. Hewitt and E. W. Sharratt (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Nature, 198: 952-7(June 8, 1963). (AERE-R-4135)

The various phenomena involved in gaseous diffusion in porous media are described in simple terms. The movement of gas molecules in the pore space of the media is considered neglecting surface, solid, and activated diffusion. Types of diffusion, the net drift effect, effect of pressure gradient, transient diffusion, and steady state diffusion measurements in graphite are considered. (C.E.S.)

27861 SUPERCONDUCTING ALLOYS OF THE $Nb_3Sn_xM_{1-x}$ TYPE. Francis Galasso, Byron Bayles, Sylvia Soehle (United Aircraft Corp., East Hartford, Conn.). Nature, 198: 984(June 8, 1963).

Since Nb_3Sn has the highest superconducting transition temperature reported, alloys with the general formula $Nb_3Sn_xM_{1-x}$, where M is germanium, silicon, aluminum, and antimony, were prepared and examined. Data on the structure, cell size, and superconducting transition temperature are reported. (C.E.S.)

27862 PHASE CHANGE AND HEAT TREATMENT OF U–Mn ALLOYS. Kō Soeno (Hitachi Ltd., [Japan]). Nippon Genshiryoku Gakkaishi, 5: 381-8(May 1963). (In Japanese)

Behavior of the transformations and grain refinement was studied using a series of uranium alloys varying in manganese content from 0.25 to 1.0 at. %. The tendency of the retention of β or γ uranium phase by quenching was examined as a function of manganese content. The β phase can be retained, while the retained γ phase could not be detected at all. TTT diagrams were determined and the existence of two modes in the β-to-α transformation is cleared. The M_s temperature increases with decreasing manganese content and activation energy of U–1.0 at. % Mn alloy is calculated as 43.5 kcal/g-atom from the β-to-α TTT diagram in nucleation and growth mechanism. Grain refinement is attained by the β-to-α transformation of nucleation and growth mode in the temperature region below the nose of the TTT diagram. (auth)

27863 IMPROVING PERFORMANCE OF STAINLESS-STEEL–UO_2 CERMET FUELS. David E. Goslee (Martin Co., Baltimore). Nucleonics, 21: No. 7, 48-52(July 1963).

The influence of materials–their size, form, and fabrication methods–on the life and reliability of stainless steel-UO_2 cermet fuels are discussed. Uniform dispersion of UO_2 particles in a deformation-resisting matrix is noted to give improved fuel element properties. Techniques that lead to improved fuels are described, and results of tests showing the improvement of fuel elements are given. (D.C.W.)

27864 PARAMAGNETIC RESONANCE OF URANIUM AND TERBIUM. B. G. Berulava and T. I. Sanadze. Paramagnitn. Rezonans (Kazan: Kazansk. Univ.) Sb. 1960, 11-13.

The electron paramagnetic resonance of U^{3+} impurities in a BaF_2 single crystal and Tb^{3+} impurities in a CaF_2 single crystal was studied at 10 to 20°K. Impurity concentration amounted to 10^{-4}%. Measurements were carried out at 8970 and 9870 Mcps in parallel fields. In the case of U^{3+} there were observed in the BaF_2 lattice 3 lines due to the presence in the lattice of three nonequivalent U^{3+} ion groups. Values obtained for the components of the g factor were: $g_{||} = 3.337 \pm 0.002$; $g_{\perp} = 2.115 \pm 0.001$. In the case of Tb^{3+} there were observed in the CaF_2 lattice 12 lines due to two causes: presence of three nonequivalent Tb^{3+} ion groups, and presence in Tb^{159} of nuclear spin $I = 3/2$. The electron paramagnetic resonance spectrum is described by the spin Hamiltonian $H = g_{||}\beta S_zH_z + AS_zI_z + \Delta_xS_x + \Delta_yS_y$ (β is the Bohr magneton, S_x, S_y and S_z are the electron spin components and $S = 1/2$) with the following values of constants: $g_{||} = 17.8 \pm 0.1$; $A = 0.209 \pm 0.001$ cm^{-1}, and $\Delta = (\Delta_x^2 + \Delta_y^2)^{1/2} = 0.173 \pm 0.001$ cm^{-1}. (OTS)

27865 THE SOFT X-RAY L_{23} EMISSION SPECTRUM FROM LIQUID ALUMINIUM. J. A. Catterall and J. Trotter (National Physical Lab., Teddington, Middx, Eng.). Phil. Mag. (8), 8: 897-902(June 1963).

The L_{23} emission spectrum obtained from liquid aluminium shows some resemblance to that of the solid but with the peak characteristic of the zone overlaps rather less pronounced. It is suggested that this result supports a model of local crystalline order in the liquid, with the valence electrons occupying an energy band having some resemblance to that of the solid. (auth)

27866 TRANSIENT CREEP AND RECOVERY IN GRAPHITE. G. M. Jenkins (Central Electricity Generating

Board, Berkeley, Glos., Eng.). Phil. Mag. (8), 8: 903-10 (June 1963).

A simple formal theory of creep in graphite is derived in which both forward and reverse thermally activated processes are considered. During the creep an internal back stress develops that reduces the rate of the forward process and increases the rate of the reverse process. At intermediate times the creep equation derived from the theory approximates to a logarithmic creep law. However, the creep rate at small time, and the total strain at infinite time, are both finite. Recovery of creep strain on removal of stress is predicted to obey the same law. The creep laws are shown to agree with experimental creep data at temperatures below 1500°C in their general form and in the linear dependence of K on both the temperature and the applied stress. Finally, a more specific model in terms of dislocation movement across periodic energy barriers is shown to be in fair agreement with the formal theory. (auth)

27867 STRESS RELAXATION AND DYNAMIC RECOVERY IN COBALT AT LOW TEMPERATURES. P. Feltham (The University, Leeds, Eng.). Phil. Mag. (8), 8: 989-96 (June 1963).

Stress relaxation in polycrystalline cobalt of 99.999% purity was studied at constant strains of up to 8% at 77–384°K. After the application of a small plastic strain increment the applied tensile stress σ diminished logarithmically with time; from the variation of the slopes of the isothermal relaxation curves with temperature and prestrain the rate controlling energy barrier was determined to be 1.61 ± 0.1 ev. This appears to be related to the formation of vacancies by intersection jogs dragged by basal dislocations. The relaxation contributed to dynamic recovery, manifest in the linear decrease of the coefficient of parabolic work-hardening $d\sigma^2/d\epsilon$ from 18.3×10^7 at 77°K to 5.8×10^7 Kg^2/cm^4 at 384°K. (auth)

27868 SELF-DIFFUSION IN MOLYBDENUM. J. Askill and D. H. Tomlin (The University, Reading, Berks, Eng.). Phil. Mag. (8), 8: 997-1001(June 1963).

The radioactive isotope Mo^{99} was used to study self-diffusion in polycrystalline and single crystal specimens of molybdenum in the temperature range 1850 to 2350°C. Diffusion zone analysis was carried out by serial sectioning with a lathe and γ-ray activity measurements with a scintillation counter. The two kinds of specimen gave similar results, diffusion coefficients in the polycrystalline material are expressed by D = 0.5 exp (–96.9/RT), and in the single crystals by D = 0.1 exp (–92.2/RT). (auth)

27869 MECHANICAL AND ELECTRICAL RELAXATION IN ThO_2 CONTAINING CaO. J. B. Wachtman, Jr. (National Bureau of Standards, Washington, D. C.). Phys. Rev., 131: 517-27(July 15, 1963).

The dynamic behavior of oxygen vacancies associated with the solid solution of CaO in ThO_2 is treated using an 8-position nearest neighbor model. This treatment predicts an internal friction peak characterized by a single relaxation time and a dielectric loss peak with a single relaxation time equal to twice the mechanical relaxation time. Both peaks were observed and are in accord with these predictions within experimental error. The activation energy for the motion of an oxygen vacancy neighboring a substitutional Ca ion in 98.5 ThO_2 + 1.5 CaO is 0.93 ± 0.02 ev. (auth)

27870 EXPERIMENTAL AND THEORETICAL STUDY OF MAGNETIC BREAKDOWN IN MAGNESIUM. M. G. Priestley (Royal Society Mond Lab., Cambridge, Eng.), L. M. Falicov, and Gideon Weisz. Phys. Rev., 131: 617-22 (July 15, 1963).

It is found that the energy-band structure of magnesium in the symmetry plane ΓKHA of the Brillouin zone is such that regions of intersecting or nearly intersecting energy surfaces give rise to magnetic breakdown. A theoretical investigation of the profiles of the energy surfaces is carried out by means of an interpolation scheme based on values of the energy at the symmetry points taken from an existing orthogonalized-plane-wave (OPW) calculation. The energy gaps due to spin-orbit effects are computed using a three-OPW approximation. Experimental measurements of the de Haas–van Alphen effect for magnetic fields close to the c axis are reported. A giant orbit of area larger than the cross section of the Brillouin zone is found. The experimental parameters for this orbit are in excellent agreement with the theoretical estimates. (auth)

27871 SOLID-SOLID TRANSITIONS IN TITANIUM AND ZIRCONIUM AT HIGH PRESSURES. A. Jayaraman, W. Klement, Jr., and G. C. Kennedy (Univ. of California, Los Angeles). Phys. Rev., 131: 644-9(July 15, 1963).

The body-centered cubic to hexagonal close-packed transformations in titanium and zirconium were studied by means of differential thermal analysis at pressures in the range 0–65 kbar and at cooling and heating rates of 3–5°C/sec. The transitions occurred at different temperatures upon heating and upon cooling and these hysteresis intervals did not appear to vary much with increasing pressure and/or contamination. Alloying with the tantalum containers and consequent lowering of the transition temperatures was unavoidable in most of the experiments. The Ti transition decreases only slightly in temperature with increasing pressure; a zero pressure volume change of less than 0.3% is suggested. The Zr transition exhibits a slope of about –2.4°C/kbar until a new transition is encountered near 58 kbar; the transition from body-centered cubic to the new Zr polymorph is without much hysteresis, and the phase boundary exhibits a slope of about 0.6°C/kbar. Discontinuities of about 17% in resistance at room temperature are detected near 51–59 kbar for Zr and 80–90 kbar for Ti, there being a decrease for Zr and an increase for the resistance of Ti. (auth)

27872 RESISTIVITY, HALL CONSTANT, AND SEEBECK COEFFICIENT OF CsAu. Frederick Wooten and George A. Condas (Univ. of California, Livermore). Phys. Rev., 131: 657-9(July 15, 1963). (UCRL-7236)

Measurements of resistivity, Hall constant, and Seebeck coefficient have established that CsAu is an n-type semiconductor with carrier concentrations 10^{18}–10^{19} cm^{-3}. The carrier concentration is essentially independent of temperature over the range 4.2–300°K and the mobility is 30–60 cm^2v^{-1} sec^{-1}. It is suggested that excess cesium introduces an impurity band that overlaps the conduction band. The Seebeck coefficient (–0.023 mv/°K at 300°K) indicates that the Fermi level lies about 0.02 ev above the conduction band based on optical lattice scattering. (auth)

27873 ON THE KINETICS OF THE DISPERSION OF SOME REFRACTORY MATERIALS. A. I. Avgustinik, V. Sh. Vigdergaus, V. M. Gropyanov, and G. V. Drozdetskaya. Poroshkovaya Met., Akad. Nauk Ukr. SSR, No. 2, 5-7(Mar.-Apr. 1963). (In Russian)

There is a correlation between thermophysical and mechanical properties and the constants of dispersion velocity of some of the investigated refractory materials. The more rigid the material the higher the constant of dispersion velocity. (auth)

27874 ON THE METHOD OF MEASURING MICROHARDNESS AND ITS DEPENDENCE ON THE COMPOSITION OF FRAGILE MATERIALS. V. N. Vigdorovich and A. Ya. Nashelskii. Poroshkovaya Met., Akad. Nauk Ukr. SSR, No. 2, 43-8(Mar.-Apr. 1963). (In Russian)

A method is proposed for measuring the microhardness of fragile materials that permit obtaining the true microhardness values. Using this method the regular change in microhardness was ascertained from the composition in the InAs–InP system, the alloys of which are fragile. At the same time the general laws of change in the physicomechanical properties as functions of the composition were confirmed for fragile materials. (auth)

27875 CRYSTALLOCHEMICAL PECULIARITIES OF BORIDES, NITRIDES, SILICIDES AND PHOSPHIDES OF TRANSITION METALS. G. V. Samsonov. Poroshkovaya Met., Akad. Nauk Ukr. SSR, No. 2, 65-79(Mar.-Apr. 1963). (In Russian)

The correlation between the crystallochemical peculiarities, the physical properties, and electron structure of the borides, nitrides, silicides and phosphides of transition metals are considered. It is shown that the determinative factors are the nature of the filling of the d-electron states of metal atoms and the values of the ionization potentials of metalloid atoms, as well as the ratio of the atomic dimensions of the components. A classification of compounds is given, based on structural types. (auth)

27876 PHASE TRANSFORMATION AT HIGH TEMPERATURES IN HAFNIA AND ZIRCONIA. William L. Baun (Wright Air Development Center, Wright-Patterson AFB, Ohio). Science, 140: 1330-1(June 21, 1963).

Phase transformation curves for HfO_2 and ZrO_2 were made. Transformation hysteresis is discussed. The transformation of monoclinic to tetragonal as temperature increases occurs over the range 1000° to 1200°C in ZrO_2, and 1500° to 1600°C in HfO_2. With decreasing temperature the transition back to monoclinic occurs from 970° to 750°C in ZrO_2 and 1550° to 1450°C in HfO_2. These transformations have been visually observed in ZrO_2, but not in HfO_2. (auth)

27877 EFFECT OF TEMPERATURE ON MECHANICAL PROPERTIES OF URANIUM. E. M. Savitskii, M. A. Tylkina, and V. F. Terekhova. Tr. Inst. Met. im. A. A. Baikova, Akad. Nauk SSSR, No. 11, 133-42(1962).

Mechanical properties of hot-rolled U (99.7% U and 0.26 to 0.25% C) were tested at −196 to 1100°C. Uranium hardness was found to drop from 332 kg/mm^2 at −196°C to 21 kg/mm^2 at 800°C. The temperature coefficient of hardness for α-uranium was found to be 0.9×10^{-3}. Cold working with 50% reduction increased the room temperature hardness by 70 kg/mm^2. The ductility of U increased and its resistance to deformation decreased with increasing temperature. In upsetting at 50 mm/min, cylindrical specimens 9.8 mm in dia and 15 mm long can withstand 33% reduction at 20°C, 60 to 75% at 500 to 600°C, and 97% at 850°C. To obtain a reduction of 10% at 100°C a stress of 90 kg/mm^2 is needed, but only 1 kg/mm^2 at 800°C. The tensile strength at room temperature was found to be 82 kg/mm^2; elongation, 2%; and reduction of area, 4%. With increasing temperature the tensile strength decreased continuously; elongation and reduction first increase, drop somewhat at 760°C, reach a maximum (~35% elongation, and 100% reduction of area) at ~1000°C, and then drop sharply. The notch toughness of U at room temperature is low (1.7 kg-m/cm^2); it rises to 7.3 at 600°C, drops to 0.5 at 750°C, and increases to ~12 kg-m/cm^2 at ~850°C. The same temperature dependence was observed in impact upsetting. (TCO)

27878 LOW-TEMPERATURE TENSILE BEHAVIOR OF Mo–0.5 Ti, Cb–15 W–5 Mo–1 Zr, AND Ta–10 W. A. G. Imgram, E. S. Bartlett, and H. R. Ogden (Battelle Memorial Inst., Columbus, Ohio). Trans. Am. Soc. Metals, 56: 214-20(June 1963).

Notched and unnotched tensile specimens of Mo–0.5 Ti, F–48 (Cb–15 W–5 Mo–1 Zr), and Ta–10 W were tested over a range of temperatures selected to encompass their ductile-to-brittle transitions. Recrystallized structures of Mo–0.5 Ti exhibited greater tendencies toward brittle behavior than did stress-relieved structures. The addition of 0.5 Ti to molybdenum lowers the transition temperature slightly. Recrystallized F–48 exhibited evidence of notch sensitivity and brittle behavior above room temperature. Stress-relieved F–48 became brittle and notch sensitive slightly below room temperature. No serious problems of brittle behavior or notch sensitivity were detected with Ta–10 W at temperatures as low as −420°F. (auth)

27879 THERMALLY-ACTIVATED DEFORMATION OF THE Bcc METALS AT LOW TEMPERATURES. H. Conrad and W. Hayes (Aerospace Corp., El Segundo, Calif.). Trans. Am. Soc. Metals, 56: 249-62(June 1963).

The activation energy H, activation volume v^*, and frequency factor ν for the deformation of Group VA (V, Cb, Ta) and Group VIA (Cr, Mo, W) metals were determined as a function of the thermal component of the stress τ^* from data in the literature on the interrelationship between stress, temperature, and strain rate. It was found that H_0 ($\tau^* \simeq 0$) $\simeq 0.1\ \mu\ b^3$ where μ is the shear modulus and b the Burger's vector, $v^* \simeq 50\ b^3$ at $\tau^* = 2$ kg per sq mm, increasing rapidly to values in excess of 100 b^3 at lower stresses and decreasing to 2 to 5 b^3 at high stresses and $\nu = 10^4$ to 10^{11} sec^{-1}. H and v^* as a function of stress were independent of structure, supporting overcoming of the Peierls-Nabarro stress as the rate-controlling mechanism. The experimental data were in agreement with Seeger's model for the thermally activated nucleation of kinks. The kink energy and the Peierls-Nabarro energy and stress derived from the data were 3 to $4 \times 10^{-2}\ \mu\ b^3$, and 2 to $4 \times 10^{-3}\ \mu\ b^3$ and 0.6 to $1.5 \times 10^{-2}\ \mu$, respectively. (auth)

27880 STUDY OF THE DEFORMATION TEXTURE OF ROLLED NIOBIUM. D. I. Layner, V. Ya. Solov'ev, E. I. Krupnikova-Perlina, and E. V. Kachur. Tsvetnye Metally, No. 11, 80-5(1962).

The main orientations in rolled Nb in the form of bars and the effects of the degree of deformation and impurities on the texture of the deformation were studied. Niobium was prepared by the carbon-thermal and sodium-thermal methods. Some of the bars were forged and then cold-rolled with intermediate annealing; the total deformation was 83%. The deformation texture was then compared for the different starting materials, which contained different amounts of impurities (O_2 – 0.152 and 0.083, N_2 – 0.04 and 0.1, C – 0.04 and 0.07, Si – 0.012 and 0.003). It was found that the technological processes involved in the preparation of Nb had no effect on the formation of the deformation texture. An increase in degree of deformation during the final rolling was accompanied by an increase in the degree of perfection of the texture of rolling. Within the limits investigated, the content of the impurities O, Ni, and C had no influence on the type or the degree of perfection of the texture. The main axes of the deformation texture of rolled Nb were (112) [110] + (100) [110]. (TCO)

27881 VLIYANIE PRIMESEI I REDKOZEMEL'NYKH ELEMENTOV NA SVOISTVA SPLAVOV. (Effect of Impurities and Rare Earth Elements on Properties of Alloys).

M. V. Pridantsev. Moscow, State Publishing House for Metallurgy, Science, and Technology, 1962. 208p.

The effects of low melting impurities and special mixtures of alkaline earth and rare earth metals on the technological, mechanical, and other related properties of steel and alloys were presented. Characteristics of specified impurity elements and the mechanism of their effects were presented systematically. Properties such as ductility, ohmic resistance, thermal stability, corrosion, and heat fractures were considered. (C.E.S.)

27882 MECHANICAL PROPERTIES OF TWO-PHASE CRYSTALLINE MATERIALS. G. S. Ansell (Rensselaer Polytechnic Inst., Troy, N. Y.). 1963. 27p.

To be presented at the International Symposium, High Temperature Technology, Sept. 1963, Asilomar, Calif.

A theoretical approach is presented to account for the observed strengthening behavior of dispersion-strengthened alloys. Two-phase crystalline solids were considered. A model is given for calculating yield strength, and results are compared with experiments. Work hardening, creep behavior, and fracture mode are also discussed. (M.C.G.)

27883 IMPROVEMENTS IN OR RELATING TO PHYSICAL PROPERTIES OF BERYLLIUM–IRON ALLOYS. Alan Moore and Frederick Morrow (to United Kingdom Atomic Energy Authority). British Patent 928,233. June 12, 1963. Filed Apr. 4, 1960.

The high-temperature ductility of cast beryllium-iron alloys is improved by heating the alloy, having an iron content of 0.037–0.45 wt %, at a temperature in the range 55–960°C for a time dependent on the iron content. Graphs are included that indicate the heating time-iron content dependence. The improved properties of the alloy heat treated in this manner are indicated. (C.E.S.)

27884 IMPROVEMENTS IN OR RELATING TO THE TREATMENT OF CARBON AND GRAPHITE ARTICLES. John Graham Campbell, Leslie Wilfred Graham, William Jonhson, and William Watt (to United Kingdom Atomic Energy Authority). British Patent 928,532. June 12, 1963. Filed Feb. 6, 1959.

The impermeability of carbon and graphite objects can be greatly improved by applying a pressure of at least 75 psi to a polymerizable liquid impregnant situated against one face of the object, thereby creating a pressure differential between the face in contact with the impregnant and the opposite face out of contact. Polymerization is then carried out at temperatures up to 200°C after which carbonization at temperatures up to 1000°C is performed. The procedure is followed for opposite sides of the object, and can be applied to articles of many shapes. (D.C.W.)

Radiation Effects

Refer also to abstracts 28091, 28102, 28429, 28474, 28475, 28476, 28477, and 28478.

27885 (AD-282467) NUCLEAR RADIATION EFFECTS ON ELASTOMERS. (North American Aviation, Inc. Space and Information Systems Div., Downey, Calif.). Apr. 11, 1962. 51p. (SID 62-386)

A survey of the literature, mainly since 1957, on the damaging effects of nuclear radiation on rubber and other elastometric materials is presented. One hundred and seventy-seven references are given in alphabetical order by author. A source index is included. (M.C.G.)

27886 (AERE-M-969) ABNORMAL KINETICS IN THE RELEASE OF INERT GASES FROM URANIUM DIOXIDE. D. Davies and G. Long (United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England). May 1963. 20p.

The methods by which deviations from normal diffusion kinetics can be detected in both in-pile and out-of-pile fission gas emission experiments are described. Available data on the anomalies observed in UO_2 are summarized, and possible mechanisms discussed. It is suggested that the observed effects in both the in-pile and out-of-pile experiments can be interpreted in terms of a combination of knock-out and pore-diffusion mechanisms. (auth)

27887 (ANL-5674) EFFECTS OF IRRADIATION ON THORIUM AND THORIUM–URANIUM ALLOYS. J. H. Kittel, J. A. Horak, W. F. Murphy, and S. H. Paine (Argonne National Lab., Ill.). Apr. 1963. Contract W-31-109-eng-38. 36p.

Three separate irradiation experiments were completed with Th and Th–U alloys. In the first experiment, three-rolled plates of Th and Th–5 wt % U alloy irradiated to total atom burnups up to 1.5% at 200°C showed no anisotropic growth and decreased in density at a rate of 1% per at.% burnup. In the second experiment, 15 swaged specimens of Th and of the alloys Th–0.1 wt % U, Th–1.4 wt % U, and Th–5.5 wt % U were irradiated to burnups ranging from 0.3 to 3.6% of all atoms at temperatures in the range of 45 to 200°C. Again, no anisotropic growth was observed and densities decreased at rates near 1% per at.% burnup. A Th–1.4 wt % U alloy specimen with 2.0 at.% burnup was found to have retained significant room-temperature ductility. In the final experiment, a group of 44 chill-cast specimens of Th alloys containing 10, 15, 20, 25, and 31 wt % U were irradiated to burnups ranging from 0.16 to 10.1% of all atoms. Maximum irradiation temperatures ranged from 260 to over 1000°C. Surface roughening occurred in the alloys containing 25 and 31 wt % U. Volume increases at any given temperature for all alloys were linear with increasing burnup. The rate of volume increase for all alloys rose from approximately 1% per at.% burnup at the lower temperatures to a value of 2.5 at 650°C. Thereafter the swelling rate increased somewhat, reaching a value of 6% volume increase per at.% burnup at 800°C. The rates of volume increase under irradiation of Th–U alloys in the entire temperature range studied were significantly less than those reported for the best U-base alloys. It is suggested that the excellent resistance to high-temperature swelling of the cast Th–U alloys resulted from the fact that a dispersion of very thin U particles was obtained. A high probability, therefore, existed for fission recoils to escape from the U particles into the isotropic and less densely packed Th matrix. (auth)

27888 (BMI-1635) FISSION-FRAGMENT-INDUCED STRESSES IN CERAMIC MATERIALS. Thomas S. Elleman, Robert B. Price, and Duane N. Sunderman (Battelle Memorial Inst., Columbus, Ohio). June 4, 1963. Contract W-7405-eng-92. 24p.

Fission fragments were recoiled into the surface of thin ceramic specimens and then the curvature produced in the specimens by the surface stresses induced was measured. Since induced curvatures were small, light-interference measurements were employed to give a sensitive measurement of specimen deflection. Results were obtained for alumina, beryllia, zirconia, quartz, magnesia, silicon carbide, and carbon. Both single-crystal and polycrystalline specimens were studied for some materials. Radiation-expansion coefficients were calculated and used to estimate the tensile and compressive stresses produced by fission-fragment irradiation of spherical ceramic coatings. The

largest expansion coefficients were obtained for silicon carbide and pyrolytic carbon, while magnesia gave the smallest expansion coefficient. Monoclinic zirconia contracted during fission-fragment bombardment, apparently due to radioinduced phase transformation to a more dense phase. (auth)

27889 (EUR-103.f) COURBES DE RAYONNEMENT GAMMA RELATIVES A L'ACIER, A L'ALUMINIUM ET A L'URANIUM. (Gamma Radiation Curves for Steel, Aluminium and Uranium). J. Frippiat and R. Nicks (European Atomic Energy Community. Nuclear Research Center, Ispra, Italy). 1962. 17p.

Gamma doses due to the thermal neutron activation are specified for steel, aluminum, and uranium; the doses are normalized to 1-gram emitters and distances of 1 cm. (auth)

27890 (HW-62762) IRRADIATION OF DEFECTED UO_2 SWAGED ROD. Preliminary Rod. J. L. Bates (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Oct. 12, 1959. Contract AT(45-1)-1350. 5p.

Investigations were made on the effects of radiation on a defected, swaged UO_2 fuel element in order to determine the effect of high surface heat fluxes on the Zircaloy cladding, the irradiation behavior of swaged UO_2 exposed to coolant water, and the relative amounts of fission product activity released during the irradiation. No activity was detected in the coolant water until the reactor reached 10 Mw (1/4 full reactor power). However, activity increased rapidly and in bursts as the reactor increased in power. Once a power level was obtained, the activity decreased to a relatively constant value for each power level. The maximum activity was observed during the increase to full reactor power from 30 Mw. The activity then decreased during constant 40 Mw operation. Bursts of activity occurred primarily during the increases in power. No indication of particulate matter was observed, nor was there any catastrophic failure of the Zircaloy-2 cladding. (P.C.H.)

27891 (JINR-P-1247) DEISTVIE PROTONOV VYSOKOI ENERGII NA KREMNIEVYE FOTOELEMENTY. (Effects of High-Energy Protons on Silicon Photoelements). B. M. Golovin, A. P. Landsman, G. M. Grigor'eva, and B. P. Osipenko (Joint Inst. for Research, Dubna, U.S.S.R. Lab. of Nuclear Problems). 1963. 27p.

A change in the operating characteristics of silicon photoelements induced by 650-Mev protons was experimentally investigated. The energy dependence of the damaging effect of nuclear bombardment on a solid was analysed. Under some simplifications the lifetimes of silicon photoelements were estimated for the radiation belts of the Earth. (auth)

27892 (NAA-SR-Memo-504) ELECTRON IRRADIATION OF ORDERED Cu_3Au. J. A. Brinkman, C. J. Meechan, and C. E. Dixon (Atomics International. Div. of North American Aviation, Inc., Canoga Park, Calif.). Nov. 11, 1952. Contract AT(11-1)-Gen-8. 7p.

An experiment was performed to determine whether the disordering of Cu_3Au by irradiation is a result of the action of thermal spikes or displacement spikes. It is known that both cyclotron and neutron irradiation will disorder Cu_3Au provided the irradiation is carried out at sufficiently low temperatures. This disordering can be explained by either of the above mechanisms. In the case of irradiation by 1 Mev electrons, however, it was not known whether disordering would occur in a similar manner. It is expected that thermal spikes will be produced by electron irradiation, but the maximum energy that can be transferred to a Cu or Au atom is too small for the production of displacement spikes. An electron irradiation of ordered Cu_3Au is described; the specimen showed no resistivity change at liquid nitrogen temperature greater than the experimental error of about 1 per cent after an irradiation of 1500 μahrs/cm^2 made at -180°C. This is interpreted as evidence for the displacement spike disordering mechanism. (auth)

27893 (TID-18843) NEUTRON EFFECTIVENESS IN PRODUCING PHOTOCONDUCTIVITY IN DIELECTRIC MATERIALS. F. N. Coppage and A. W. Snyder (Sandia Corp., Albuquerque, N. Mex.). June 1963. Contract AT (29-1)-789. IEEE Paper No. CP-63-1118. 20p. (SCDC-3125)

Measurements of photoconductivity in several organic dielectrics irradiated with neutrons and gamma rays reveal that neutrons, relative to gamma rays, are less effective, per unit absorbed-dose rate, in causing photoconduction. Photoconductivities of polystyrene, polyisobutylene, Mylar, H-film, reconstituted mica, cellulose acetate, and polycarbonate were measured during exposures in the Sandia Pulsed Reactor. The ratio ($\dot{n}/\dot{\gamma}$) of the neutron absorbed-dose rate ($\dot{n}$) to the gamma-ray absorbed-dose rate ($\dot{\gamma}$) was varied with preferential shielding to separate the components of photoconduction arising respectively from neutrons and gamma rays. The empirical equation, $\sigma = A_n\dot{n}^\delta + A_\gamma\dot{\gamma}^\delta$, was found to fit the data of the measured photoconductivity (σ), where A_n, A_γ, and δ are empirical constants characteristic of a dielectric material. The ratio, A_n/A_γ, is a measure of the effectiveness of neutrons, relative to gamma rays, in producing photoconduction and for the materials studied $0.06 \leq (A_n/A_\gamma) \leq 0.55$. The ratio, A_n/A_γ, for two samples of the same dielectric type contained in capacitors of two manufacturers was observed to differ by as much as a factor of two. The origin of the difference was not determined. (auth)

27894 (TID-18856) RADIATION EFFECTS ON LEAD ZIRCONATE TITANATE FERROELECTRICS. D. D. Glower and D. F. Warnke (Sandia Corp., Albuquerque, N. Mex.). June 1963. Contract AT(29-1)-189. IEEE Paper No. CP-63-1137. 18p. (SCDC-3126)

Radiation effects studies were completed which indicate that the radiation-induced defects that cause an increase in the lattice parameter and a distortion of the hysteresis loop are different since they anneal at different temperatures. Isochronal annealing experiments reveal that defects which have completely eliminated the remanent polarization are annealed by temperature cycling 65/35 and 68/7 PZT ceramics to 750 and 325°C, respectively. The lattice parameter, which was increased due to radiation-induced reactions, does not anneal after high-temperature cycling. The increased fragility which occurs due to radiation-induced strain in the crystals does not appear to temperature anneal. (auth)

27895 (TID-18857) GAMMA-RAY PHOTOCONDUCTIVITY DECAY IN ORGANIC DIELECTRIC MATERIALS. S. E. Harrison (Sandia Corp., Albuquerque, N. Mex.). June 1963. Contract AT(29-1)-789. IEEE Paper No. CP-63-1143. 19p. (SCDC-3134)

From experimental data it was determined that gamma-ray photoconductivity decay in a number of organic dielectric materials can be characterized to good approximation by $\sigma(t)/\sigma_0' = \Sigma_{i=1}^{n} K_i e^{-t/\tau_i}$, where $\sigma(t)$ is the conductivity as a function of time during the decay, σ_0' the conductivity at time zero immediately prior to removal of the gamma-ray intensity, n the number of decay time constants in the de-

cay, τ_i the magnitude of the i^{th} decay time constant, and k_i the weighting factor associated with the i^{th} decay time constant. Experimental values for n, τ_i, k_i, and σ_0' were measured for Teflon, polyethylene, polyvinylchloride, polystyrene, Kel-F, and nylon. The data were taken at 29 to 80°C and gamma-ray intensities from 3.3 to 6.7 rads (H_2O)/sec. The experimental results were interpreted in terms of a trap-controlled process, assuming a one-carrier model, and within the approximation that during the decay the rate at which carriers enter the traps from conducting states is small compared to the rate at which carriers leave the traps. The mean time a charge carrier remains in the i^{th} trapping state before being thermally freed into a conduction state is τ_{ia0} and is identical to the measured decay time constant, τ_i. (auth)

27896 (TID-18907) MODIFICATION OF WOOD WITH POLYMERS FORMED BY HIGH ENERGY RADIATION. J. A. Kent, A. Winston, and W. Boyle (West Virginia. Univ., Morgantown). [1963]. Contract [AT(40-1)-2945]. 9p.

A review is presented on the radioinduced graft polymerization of polymers to wood. The method is given along with properties of the combinations. (P.C.H.)

27897 (WAPD-T-1501) MICROSTRUCTURAL CHANGES ASSOCIATED WITH IRRADIATION BURNUP OF URANIUM DIOXIDE. Thomas R. Padden and Paul S. Schnizler (Westinghouse Electric Corp. Bettis Atomic Power Lab., Pittsburgh). Aug. 1962. Contract AT(11-1)-Gen-14. 31p.

Observations of microstructural changes associated with UO_2 burnup from 3.5×10^{20} to 31.3×10^{20} Fiss/cm^3 (1.5 to 13.4 at. % burnup) at 1940°F or less are described. There was subdivision of the grains in the higher end of the burnup range investigated; the subdivision started between 12.9×10^{20} and 16.9×10^{20} Fiss/cm^3 and was complete at 23.2×10^{20} Fiss/cm^3. There was a disappearance of porosity in the lower end of the burnup range investigated and a reappearance of porosity at the higher end. There was a segregation of chemically reactive material, presumed to be fission products, in the grain boundaries at the lower burnups and in the sub-grains at the higher burnups. There was definitely segregation of at least one fission product, Cs^{137}, in this reactive boundary material. At 12.9 and 16.9×10^{20} Fiss/cm^3, the Knoop hardness was significantly higher than the unirradiated fuel but at still a higher burnup there was a drop in hardness apparently related to the grain subdivision and segregation of fission products. (auth)

27898 TEMPERATURE AND ILLUMINATION DEPENDENCE OF IRRADIATION DAMAGE IN SILICON. Herman J. Stein (Sandia Corp., Albuquerque, N. Mex.). Appl. Phys. Letters, 2: 235-6(June 15, 1963). (TID-18715; SCDC-3232)

The effects of irradiation temperature and illumination on minority carrier lifetime degradation in phosphorus-doped silicon were investigated. Measurements were performed on 6-ohm-cm, vacuum-floating-zone samples irradiated with Co^{60} gamma rays. A major part of the temperature dependence of the defect introduction rate was attributed to the charge state of the defects immediately after formation. (C.E.S.)

27899 EFFECT OF GAMMA IRRADIATION UPON WOOL FIBERS. Masao Horio, Kazuo Ogami, Takashi Kondo, and Ken'ichi Sekimoto (Kyoto Univ.). Bull. Inst. Chem. Res., Kyoto Univ., 41: 1-9(Mar. 1963). (In English)

Wool fibers were irradiated by Co^{60} gamma rays, and several radiation effects were measured. The statistical analysis resulted in the conclusion that any appreciable changes in tensile strength and elastic modulus would not be brought about by the irradiation with doses under 10^7 roentgens. The radiation damage of fibers is statistically probable only for 10^8 roentgens or greater doses. The problem of generating crosslinking in wool fibers by irradiation has thus far been neglected in the literature, but the remarkable change in dye-accessibility and solubility of wool fibers caused by the irradiation with smaller doses ranging from 10^3 to 10^5 roentgens suggests the production of crosslinking. (auth)

27900 POLYMERIZATION OF STYRENE, METHYL METHACRYLATE, AND ACRYLONITRILE ONTO WOOL BY GAMMA IRRADIATION. (PRELIMINARY REPORT). Masao Horio, Kazuo Ogami, Takashi Kondo, and Ken'ichi Sekimoto (Kyoto Univ.). Bull. Inst. Chem. Res., Kyoto Univ., 41: 10-16(Mar. 1963). (In English)

Styrene, methyl methacrylate, and acrylonitrile were polymerized onto wool by irradiating it in the solution of each of these monomers by the gamma rays. The radiation doses applied ranged from 2×10^5 to 4×10^6 roentgens. A considerable amount of polymer was fixed onto wool after thorough extraction, which was defined as the amount of grafting. The stress-strain curves of fibers grafted moderately by the monomers are modified with the result that the initial modulus, stress at yield point, and tensile strength in dry and wet state are increased, while the large extensibility characteristic to wool is well retained. Extremely highly grafted fibers lose the original character of wool and become brittle. Supercontraction is reduced by grafting the wool moderately by the monomers, but, when the amount of grafting is too large, the character of wool is overcome by that of synthetic polymer. Microscopic examination revealed that the scales of fibers grafted highly by styrene are splitted hither and thither giving spaces to the grafting polymer. Association of synthetic polymer with wool cannot be simply attributed to grafting. (auth)

27901 EFFECTS OF RADIATIONS ON COLOUR OF PEARL AND ON AMINO ACID COMPOSITION OF CONCHIOLIN IN PEARL. Hiroyuki Hatano and Shigetake Ganno (Kyoto Univ.). Bull. Inst. Chem. Res., Kyoto Univ., 41: 83-8(Mar. 1963). (In English)

After exposure to radiations of γ rays of Co^{60}, neutrons of a reactor, and high-speed electrons of a Van de Graaff linear accelerator, pearls of pearl oysters and of fresh water mussels were changed in color from "white" to "black" of the pearls. The changes were measured by a reflectospectrophotometer, and characterized on an I.C.I. chromaticity diagram. The remarkable change in color of the fresh water pearls was attributed to a denatured damage of the proteinous component by γ irradiation. Amino acid analysis of the proteinous component of the fresh water pearls was performed by an automatic amino acid analyzer before and after exposure to γ irradiation. Radiation sensitivity of amino acids in rigid solid of the pearl was compared with that in free solution and in protein solution. (auth)

27902 EFFECTS OF GAMMA RADIATION ON POLYMER IN SOLUTION. IV. CROSSLINKING AND DEGRADATION OF POLY(ACRYLIC ACID) IN AQUEOUS SOLUTION. Ichiro Sakurada and Yoshito Ikada (Kyoto Univ.). Bull. Inst. Chem. Res., Kyoto Univ., 41: 103-13 (Mar. 1963). (In English)

Dilute aqueous solutions of poly(acrylic acid) in acid form and in sodium-salt form were irradiated with gamma rays from a Co^{60} source both in the presence and in the

absence of air. Changes in gelation dose and viscosity were measured. On irradiation in the absence of air, gel formation was observed, and both the gelation dose and the critical concentration for gel-formation increased as the degree of neutralization of polymers increased. The critical concentrations were 0.25, 0.30, 0.56, and 1.0 wt %, for polymers with degrees of neutralization of 0, 5, 10, and 20%, respectively. When NaCl was added to the solution for irradiation so as to diminish the ionization of carboxyl groups, gelation occurred more readily with increasing NaCl concentration, if the NaCl concentration was relatively low. However, as the concentration of NaCl became higher than 0.01N, gel formation was increasingly suppressed with increasing NaCl concentration. This fact demonstrates that there is an optimum expansion of polyion for crosslinking in aqueous solution. On irradiation in the presence of air, the polymer appeared to degrade exclusively. The higher the degree of neutralization, the higher the degree of degradation. If, however, NaCl was present sufficiently in the solution for irradiation, degradation did not occur practically. (auth)

27903 EFFECTS OF GAMMA RADIATION ON POLYMER IN SOLUTION. V. INTRA-MOLECULAR CROSSLINKING OF POLY(ACRYLIC ACID) IN DILUTE AQUEOUS SOLUTION. Ichiro Sakurada and Yoshito Ikada (Kyoto Univ.). Bull. Inst. Chem. Res., Kyoto Univ., 114-22 (Mar. 1963). (In English)

Previous work has shown that gelation of poly(acrylic acid) in solution occurs most readily in acid form in the presence of 0.01N NaCl. The present investigation was carried out to elucidate in more detail the mechanism of crosslinking occurring in these concentration ranges. Irradiation of the deaerated solutions below the critical concentration led to main-chain scission when NaCl concentrations of solutions to be irradiated were lower than 0.01N. However, in the case of the solutions containing NaCl above 0.01N, the solutions became turbid on irradiation. Detailed studies on properties of these turbid solutions revealed that the origin of turbidity can be attributed to the formation of intra-molecular crosslinking. The reduced viscosities of the intra-molecular-crosslinked polymer were considerably lower than those of the linear polymer over the polymer concentration range studied, and the increase in the reduced viscosity usually observed at lower concentrations was very slight in the case of intra-molecular-crosslinked polymer. The values of pH of the intra-molecular-crosslinked polymer were higher than those of the linear polymer. The present study confirms the conclusion in the previous paper that the crosslinking of polyelectrolyte in aqueous solutions can be explained only in terms of both the change in expansion and the repulsion due to ionized groups. (auth)

27904 EFFECTS OF GAMMA RADIATION ON POLYMER IN SOLUTION. VI. RADIATION PROTECTION AND PROMOTION IN AQUEOUS SOLUTIONS OF POLY(VINYL ALCOHOL). Ichiro Sakurada and Yoshito Ikada (Kyoto Univ.). Bull. Inst. Chem. Res., Kyoto Univ., 41: 123-30 (Mar. 1963). (In English)

Effects of a number of additives were measured for irradiation of deaerated and aerated aqueous solutions of poly(vinyl alcohol). Systems containing thiourea, methyl ethyl ketone, ethanol, $FeSO_4$ + 0.8N H_2SO_4, $CuSO_4$, or KBr were examined in detail and it was found that these additives modified the rate of crosslinking as well as degradation of polymers. On the contrary, methanol, K_2SO_4, or NaCl did not have any appreciable influence on polymer reactions, although their concentration was fairly high compared with that of the former additives. The various effects of additives could be explained mainly in terms of recombination process and radical transfer in the case of organic additives and electron transfer in the case of inorganic additives. The minimum number of additive molecules per initial polymer molecule required to affect the crosslinking were 0.08 (thiourea), 0.27 ($FeSO_4$ + 0.8N H_2SO_4), 0.5 ($CuSO_4$), 3 (MEK), 10 (KBr), and 17 (ethanol). Discussion of the mechanism of radiation protection and promotion was given on the basis of these experimental results. (auth)

27905 ON THE POSSIBILITY OF STRENGTHENING STEEL IN ELECTRON IRRADIATION. B. D. Grozin and V. S. Chernenko. Dopovidi Akad. Nauk Ukr. RSR, No. 2, 202-5(1963). (In Ukrainian)

Theoretical considerations permit the possibility of strengthening steel as a result of electron irradiation. Experiments have confirmed the correctness of this premise. The hardness of steel is raised to 900–950 kg/mm^2 on electron irradiation. The irradiated zone has a specific microstructure. (auth)

27906 FAULTS CREATED IN SOLIDS BY BOMBARDMENT WITH CHARGED PARTICLES. PART III. André Degeilh and René Simon (CNRS, Paris). Ind. At. 7: No. 3-4(81-92(1963)). (In French)

The discussion of a simplified theory of displacements is continued and concluded with a consideration of substitution collision and experimental results on metal irradiation. Recent theoretical results on shock propagation in solids are discussed. (J.S.R.)

27907 GAMMA RADIATION EFFECTS ON DIELECTRIC PROPERTIES OF INSULATING MATERIALS. 5. POLYETHYLENTERPHTHALATE. B. I. Vorozhtsov, N. I. Ol'shanskaya, and I. G. Vorozhtsova (Tomsk State Univ., Siberian SSR). Izv. Vysshikh Uchebn. Zavedenii, Fiz., No. 2, 75-7(1963). (In Russian)

Measurements of polyethyleneterphthalate dielectric properties in a 2000 r/min x-ray field showed that the conductance and the tangent of the angle of dielectric loss increase at low frequencies (20 to 10^3 Hz). An increase in temperature inhibits the growth of σ and tgσ is reduced. Dielectric parameter variations depend on the degree of crystallinity. The observed effects are of a reversible character. (tr-auth)

27908 EFFECTS OF γ RADIATION ON CERTAIN GALLIUM ARSENIDE PROPERTIES. M. A. Krivov, E. V. Malisov, and S. V. Malyanov (Tomsk State Univ., Siberian SSR). Izv. Vysshikh Uchebn. Zavedenii, Fiz., No. 2, 114-18(1963). (In Russian)

The influence of γ radiation on electric conductivity and Hall effect in 20 × 2 × 2 mm gallium arsenide monocrystals was investigated using a Co^{60} source. Studies of electric conductivity as a function of integral γ flux indicated diminishing conductance in both n and p type specimens. At room temperature irradiation inhibited the mobility of current carriers and the Hall constant. Structural disturbances resulting from γ irradiation are stable. (R.V.J.)

27909 THE CARBON LEVELS IN RADIATION-DAMAGED AND STRAIN-AGED MILD STEEL. J. E. McLennan and E. O. Hall (Newcastle Univ. Coll., New South Wales, Australia). J. Australian Inst. Metals, 8: 191-6(May 1963).

The carbon remaining in solution in mild steel after neutron irradiation (10^{18} and 10^{19} nvt) and subsequent recovery treatments was determined using a low frequency torsion pendulum. The carbon left in solution

after annealing followed by a furnace cool was lowered by the irradiation. The reduction in carbon was greater for the larger neutron dose. Anneals for 1 hour at increasing temperatures showed a constant carbon level up to 300°C, above which there was a gradual increase in the amount in solution towards the unirradiated level. Cold working the irradiated material caused a further lowering of carbon in solution after subsequent anneals. It is suggested that the lowering is due to the association of carbon atoms with vacancies. The kinetics of carbon precipitation were followed in annealed mild steel containing 0.003 wt % C in solution, after straining 20% using the same internal friction technique. At all the temperatures studied, 27 to 62°C, the precipitation appeared to be controlled by two reactions. Up to ~30% precipitation, atmosphere formation following Bullough and Newman seems likely; beyond this point diffusion-controlled precipitation is a possible explanation. (auth)

27910 MICROSTRUCTURAL CHANGES IN NEUTRON-IRRADIATED GRAPHITE. P. A. Thrower and W. N. Reynolds (Atomic Energy Research Establishment, Harwell, Berks, Eng.). J. Nucl. Mater., 8: 221-6(Mar.-Apr. 1963). (AERE-R-4007). (In English)

The technique of replica electron microscopy was applied to the study of growth in neutron-irradiated graphite and has confirmed suggestions made elsewhere on the basis of macroscopic observations. The effect of annealing on high dose irradiations was also studied. Etch pits formed during the preparation of specimens were observed on irradiated reactor graphite and also on a compact of naturally occurring graphite crystals. These are identified with a complex dislocation structure along grain boundaries. (auth)

27911 THE EFFECT OF IRRADIATION UPON THE ELECTRICAL RESISTIVITY AND THERMAL CONDUCTIVITY OF α-URANIUM. A. D. Brailsford and K. G. Major (English Electric Co. Ltd., Whetstone, Eng.). J. Nucl. Mater., 8: 241-7(Mar.-Apr. 1963). (In English)

An estimate was made of the effect of radioinduced lattice defects upon the electrical resistivity and thus, assuming the Wiedemann-Franz law is obeyed, on the thermal conductivity of α-uranium. Estimates were made of the equilibrium concentrations of interstitials and vacancies. Allowance was made for the effect of porosity, but the clustering of defects was otherwise neglected. (auth)

27912 COLLECTION OF HELIUM IN SINTERING OF BERYLLIUM OXIDE IRRADIATED WITH NEUTRONS. M. Salesse, R. Caillat, and J. Elston (Centre d'Etudes Nucléaires, Saclay, France and Service de Chimie des Solides, Gif-sur-Yvette, France). J. Nucl. Mater., 8: 268-70(Mar.-Apr. 1963). (In French)

Studies were made on bubble formation in BeO irradiated with 2.2×10^{20} neutrons/cm^2, then annealed at 1200°C. It was demonstrated that the bubbles are collections of helium. Measurements of the specific heat confirmed that helium, to 600°C, begins to evolve in the crystalline network of BeO. (P.C.H.)

27913 RECOVERY OF IRRADIATION HARDENING OF COPPER SINGLE CRYSTALS AROUND 0°C. Hideji Suzuki and Akira Furusawa (Japan Atomic Energy Research Inst., Tokyo). J. Phys. Soc. Japan, 18: 667-72(May 1963). (In English)

The hardening of copper single crystals irradiated with about 10^{16} fast neutrons/cm^2 in a pile at about 90°K was investigated and the recovery of the hardening by annealing at up to room temperature was studied. A bump was always observed in the region of easy glide if the crystal was not annealed by more than 30 minutes at 0°C. Small serrations were also observed in the region of easy glide before the bump, and they disappeared at the same annealing condition as the bump. A divacancy mechanism is proposed to explain these observations. (auth)

27914 IRRADIATION OF POLYETHYLENE OXIDE AND POLYPROPYLENE. R. Salovey and F. R. Dammont (Bell Telephone Labs., Inc., Murray Hill, N. J.). J. Polymer Sci., Pt. A, 1: 2155-62(June 1963). (In English)

The solubility behavior of electron-irradiated (in vacuo) polyethylene oxide indicates a ratio of main-chain scission density to the density of crosslinked units of 0.6, independent of molecular weight. This value, derived from measurements at high doses, correlates well with the observed increase in intrinsic viscosity and invariance of number-average molecular weight at low irradiation doses. Analogous measurements on polypropylene indicate a linear dependence of $S + S^{1/2}$ (where S is the sol fraction of the irradiated polymer) on the reciprocal irradiation dose. This treatment leads to a ratio of scission-to-crosslinking of 0.8. Increased scission in polypropylene as compared to polyethylene oxide is evidenced by a gradual decrease in the intrinsic viscosity as a function of dose. This decrease is not indicative of an initial irradiation degradation of the polymer, because the number-average molecular weight is relatively unaffected by irradiation until quite close to the gel point. The intrinsic viscosity of the progressively crosslinked polymer is apparently depressed by branching. Direct comparison of the results on polypropylene with theory is uncertain because of a nonrandom initial molecular weight distribution. It is reemphasized that the intrinsic viscosity is not a simple indication of molecular weight changes in crosslinking polymers. (auth)

27915 THE INFLUENCE OF IONIZING RADIATION ON RUBBER. Pavel Mrkous. Jaderna Energie, 9: 117-23 (1963). (In Czech.)

The values of mechanical properties of thirteen types of rubber changed by the influence of ionizing radiation are reported. The changes of tensile strength, ductility, hardness, and specific weight are described. (auth)

27916 DIELECTRIC BEHAVIORS OF γ-RAY IRRADIATED TRIGLYCINE SULFATE. Koichi Toyoda, Akira Kawabata, and Tetsuro Tanaka (Kyoto Univ.). Japan. J. Appl. Phys., 2: 311(May 1963). (In English)

Triglycine sulfate crystals were subjected to γ radiation from a Co^{60} source of intensity 2.27×10^5 r/hr. It is shown that the ferroelectric curie point shifts to lower temperature, and the maximum peak of dielectric constant decreases with increasing dosage. The dielectric loss tangent showed decrease for ferroelectric range and increase for paraelectric range. The crystal after irradiation reveals a biased double hysteresis loop as in the case of x radiation. The piezolectric property was remarkably affected for small dosages and tended to a constant value for large doses. (C.E.S.)

27917 PILE-IRRADIATION INDUCED CRYSTAL STRUCTURE CHANGE OF DIFFERENT GRAPHITES AND INFLUENCE OF THE DEGREE OF ORDER ON THE RADIATION EFFECT. O. Hauser and M. Schenk (Zentralinstitut für Kernphysik, Rossendorf, Ger.). Kernenergie, 6: 157-62(Apr. 1963). (In German)

Graphite in various three-dimensional degrees of order was irradiated to 2.8×10^{19} n/cm^2 (neutron energy ≥ 1 Mev). Before and after the irradiation x-ray investigations of the lattice parameters and interference changes as well as

measurements of the electric conductivity and the Hall coefficient were carried out. The radioinduced changes at equal irradiation were about the same as for starting materials with a high degree of order and greater than for starting materials with a lower degree of order. For the radioinduced "degraphitization" of hexagonal graphite, the turbostratic modification was not formed. The "degraphitization" is therefore not a quantitative inversion of graphitization. (tr-auth)

27918 ELECTRON SPIN RESONANCE IN NEUTRON-IRRADIATED DIAMOND. E. A. Faulkner, E. W. J. Mitchell, and P. W. Whippey (Univ. of Reading, Eng.). Nature, 198: 981-2(June 8, 1963).

Room-temperature measurements at 9 Mc on four specimens of type IIa diamond subjected to irradiation with fast neutrons at 50°C are presented. The main feature of the spectrum is a broad absorption centered at g = 2.00, with a half-power width of ~80 gauss. This line shows a weak anisotropic structure in the two less heavily irradiated specimens, but appears smooth in the other specimens; the line has very long tails and its shape is not Lorentzian. There is no evidence of a dependence of the half-power line width on irradiation dose. These results are compared with previous results from electron irradiation. (C.E.S.)

27919 RADIATION EFFECTS ON ELECTRONIC COMPONENTS. Shigeru Hayakawa (Matsushita Elect. Ind. Co., Ltd., [Japan]), Hiroshi Ikushima, Kiyotaka Wasa, Oichiro Horiki, Hideo Tomioka, and Tokuo Suita. Nippon Genshiryoku Gakkaishi, 5: 388-95(May 1963). (In Japanese)

The effects of γ-irradiation and pile irradiation on electronic components were studied. In view of the importance of dynamic properties in radiation environment, their changes were measured chiefly during γ-irradiation and were recognized mostly in the course of exposure to γ rays; generally, recovery occurs upon removal from the radiation field. Permanent effects were observed in resistors and transistors in varying degrees. Measurements of pile irradiation effects on electronic components were carried out only after irradiation. Only magnetic materials (ferrite cores) among the passive elements (capacitor, resistor, magnetic core and so on) showed especially heavy changes in their properties. Diodes and transistors among the active elements exhibited appreciable changes. It is to be noted that they have lost the action upon exposure to an integrated neutron flux of 10^{16} nvt. Changes in diodes are in different directions according to bulk material. Silicon diode degrades, fairly in forward characteristics, while germanium diode does in the reverse direction. Generally I_{co} and β of transistor increases and decreases respectively, with increasing radiation dose. (auth)

27920 THE GENERATION OF DISLOCATIONS IN METALS BY LOW ENERGY ION BOMBARDMENT. Piers Bowden and D. G. Brandon (Cambridge Univ., Eng.). Phil. Mag. (8), 8: 935-50(June 1963).

Thin foils of gold, copper, and nickel were bombarded on one surface with a beam of 100 ev argon ions at normal incidence. Glissile and Frank-sessile dislocation loops and dislocation dipoles were formed close beneath the bombarded surface, and both the type of loop and their arrangement were found to depend critically on the crystallographic orientation of the surface. The results are interpreted in terms of the stability of different dislocation arrangements near free surfaces of differing orientation. The condition for the stability of both glissile and sessile loops in gold is that their Burgers vectors should lie within approximately 5° of the plane of the surface. Only glissile loops were observed in copper. Sessile loops were more numerous in nickel than in gold. (auth)

27921 THE EFFECT OF ELECTRON IRRADIATION ON THE INTERNAL FRICTION OF COPPER BETWEEN 10°K AND 80°K. Jenifer N. Lomer (Univ. of Reading, Eng.). Phil. Mag. (8), 8: 951-5(June 1963).

The change in the internal friction of copper was measured during warm-up of specimens after electron irradiation near 10°K. The damping was found to decrease between 33°K and 55°K. The decrease is attributed to a defect becoming mobile in this temperature range, and the relation to the annealing of the electrical resistivity in electron irradiated copper is discussed. (auth)

27922 A HARDENING EFFECT ASSOCIATED WITH STAGE III RECOVERY IN NEUTRON IRRADIATED MOLYBDENUM. A. S. Wronski and A. A. Johnson (Imperial Coll. of Science and Tech., London). Phil. Mag. (8), 8: 1067-70(June 1963).

Polycrystalline tensile specimens of molybdenum of average grain diameter 75μ were irradiated at ~40°C with an epithermal neutron dose of approximately 2×10^{18} nvt. Specimens were annealed for one hour at temperatures of 100, 180, 260, 350, 500, 610, 705, and 820°C. Groups of unirradiated specimens, irradiated and annealed specimens, and irradiated but unannealed specimens were tested at room temperature in a tensometer at a strain rate of 0.9×10^{-4} sec^{-1}. The effect of the radiation was to increase the yield stress without significantly altering the rest of the load-elongation curve. (C.E.S.)

27923 EFFECT OF ELECTRON-ELECTRON SCATTERING ON THE ELECTRICAL AND THERMAL CONDUCTIVITY OF METALS. Joachim Appel (General Atomic Div., General Dynamics Corp., San Diego, Calif.). Phil. Mag. (8), 8: 1071-5(June 1963).

The effect of interelectronic scattering processes on the electrical and thermal conductivity of metals is considered for two simple cases: one unfilled parabolic band and two unfilled parabolic bands corresponding to one s-band and one inverted d-band. The first case corresponds to an alkali metal and the second to a transition metal. Electron-hole scattering is also considered and is found to have effects of the same magnitude as electron-electron scattering on the thermal conductivity of the metals. (C.E.S.)

27924 EFFECTS OF PENETRATING RADIATIONS IN SPACE ON PHOTOGRAPHIC MATERIALS AND OTHER DETECTORS. A. A. Aintablian (Lockheed Missiles and Space Co., Sunnyvale, Calif.), E. E. Gaines, and J. C. Lewis. Photo. Sci. Eng., 7: 183-8(May-June 1963).

An experimental study of penetrating radiation was conducted to determine the effects of space radiation on various special photographic materials. Three experimental packages were prepared, placed in satellites, orbited and recovered, and data analyzed. The first experimental package was exposed on orbit to 0.5, and the second and third experienced exposures of 0.06 r. The sensitometric properties of the photographic materials were found to be negligibly affected by the exposures to orbital radiation. (auth)

27925 TRACKS OF CHARGED PARTICLES IN HIGH POLYMERS. R. L. Fleischer and P. B. Price (General Electric Research Lab., Schenectady, N. Y.). Science, 140: 1221-2(June 14, 1963).

Heavily ionizing particles create trails of damage as they move through materials. In both addition and condensation polymers these trails can be selectively dissolved so that the sites and the directions taken by the moving particles are revealed. These materials thus serve as simple detectors of heavily charged particles. (auth)

27926 RADIATION AND COLOR MATERIALS. Shikizai Kyokaishi, 35: 541-92(Dec. 1962). (In Japanese)

Reviews are presented on radioinduced polymerization, radiation induced graft copolymerization, effects of ionizing radiation on drying oils, radiation effects and protective coatings, protective layers of the secondary radiation, and radiosterilization. Extensive bibliographies are included. (TCO)

27927 RADIATION DEFECTS IN LITHIUM-DOPED SILICON. I. V. Smirnova, V. A. Chapnin, and V. S. Vavilov (Moscow State Univ.). Soviet Phys.-Solid State (English Transl.), 4: 2469-74(June 1963).

The spectrum of levels of the localized centers produced by fast-electron bombardment of lithium-doped silicon was investigated by measuring the temperature dependence of the Hall effect. Deep energy levels were found in the upper and lower halves of the forbidden band. The kinetics of the process of interaction between lithium ions and point defects (vacancies) was used to estimate the radius of capture characterizing the ion-vacancy interaction. Information was obtained on the thermal stability of the investigated localized centers produced by radiation. (auth)

27928 THEORY OF THE ANNIHILATION OF RADIATION DEFECTS IN SEMICONDUCTORS. A. V. Spitsyn and L. S. Smirnov (Lebedev Inst. of Physics, Moscow). Soviet Phys.-Solid State (English Transl.)., 4: 2529-32 (June 1963).

On the basis of an analysis of experimental data on radiation defect annealing in germanium and silicon, it is concluded that the influence of impurities is important in the process of radiation-defect annihilation. It is suggested that impurity atoms can "capture" vacancies that form one of the components of the simplest structural defects–Frenkel pairs. A description is given of the kinetics of annihilation that allows for the influence of impurities. From these considerations an expression is obtained for the dependence of the radiation-defect concentration on the duration of annealing. It is found that this dependence agrees satisfactorily with the published experimental data. (auth)

27929 NEUTRON IRRADIATION OF SILICON p-n JUNCTIONS. Yu. R. Nosov. Soviet Phys.-Solid State (English Transl.), 4: 2680(June 1963).

An attempt was made to establish a practical limit to the use of neutron bombardment of Si for reducing the lifetime of nonequilibrium carriers in Si devices. P-n junctions prepared by fusing Al wire into n-type Si crystals were irradiated (some were subsequently quenched from 1200°C), and the diodes so formed were subjected to current and voltage reversals. The charge carried by the transient reverse current was measured, as were the forward and reverse resistances for the junctions. Results indicate that lifetime reduction in the base of a Si diode by neutron bombardment is applicable only to about 0.1 μsec. (D.C.W.)

27930 SOME PROBLEMS CONCERNING THE TECHNOLOGY OF HEAVY CONCRETES FOR PROTECTION AGAINST RADIOACTIVITY EFFECTS. A. E. Desov and V. I. Nadol'skii. Tr., Nauchn.-Issled. Inst. Betona i Zhelezobetona, No. 29: 4-36(1962).

Data are given on the shielding properties of special concretes made from flue dust, limonite, serpentinite, magnetite, and hydro-goethite ore with cast iron shot and boron carbide additions. The strength of flue-dust concrete was somewhat higher than that of limonite concrete. The moisture loss at 18 to 20°C for concretes made from two Portland cements was 3% for magnetite concrete, 5% for serpentinite concrete, and 7% for magnetite concrete with flue dust. For concretes prepared from gypsum plaster–aluminous cement it was much less: 2% in case of magnetite concrete with flue dust. Losses in weight of limonite concrete with shot and boron carbide additions were 3 to 3.8% at 18°C, 4.5 to 5.6% at 100°C, 5.4 to 5.8% at 150°C, and 5.9 to 6.4% at 200°C. The composition-dependent strength drop of special concretes, determined on cubic samples, was contained within 24 to 38% at temperatures up to 200°C. The strength values determined on prismatic samples dropped more sharply. Concretes with additions of Cd and Ba salts did not show losses in strength after a 100-day irradiation with Co^{60} (activity 2.5 g-equivalent of Ra). (TCO)

27931 EFFECT OF IONIZING RADIATION ON THE STRUCTURAL CHANGES IN RUBBER-PLASTIC SYSTEMS. G. A. Blokh, V. A. Zhurko, M. A. Vyazankina, M. A. Vas'kovskaya, A. P. Meleshevich, F. V. Bronshteyn, and E. V. Tsipenyuk. Vysokomolekul. Soyedin., 5: 605-13 (Apr. 1963).

Structural changes produced by ionizing radiation in doses of 1 to 100 Mr in rubber–plastic systems were studied. The changes in properties were evaluated from thermomechanical curves in the range from about 60 to 220°C and from swelling data. The experiments were conducted with systems of sodium butadiene, butadiene–styrene, or natural rubber and low- or high-pressure polyethylene or polystyrene (rubber : plastic ratios, 80 : 20, 50 : 50, and 20 : 80) irradiated in air without heating. The thermomechanical curves of individual nonirradiated and irradiated systems differ sharply from one another. At a given temperature and radiation dose, network structure formation, indicated by a loss of deformability and by the absence of viscous flow, was shown to be induced by irradiation. The density of cross links in individual systems was shown to increase with an increase of the dose and to depend on the nature of the rubber and the rubber-to-plastic ratio. In polymers containing phenyl groups radioinduced structural changes proceeded slower and required higher radiation doses. Analysis of the results of the study indicates that ionizing radiation apparently causes a covulcanization of the rubber and the plastic and is accompanied by a change in the physical and mechanical properties of the system: a sharp decrease in plasticity, a decrease in swelling, and increases in hardness, tensile strength, and wear resistance. It was concluded that irradiation of combinations of rubbers and plastics in predetermined ratios makes possible the production of materials with the desired improved properties. (OTS)

27932 DETERMINATION OF DIFFUSION LENGTH AND THE AVERAGE ENERGY REQUIREMENT FOR THE FORMATION OF ELECTRON-CAVITY PAIRS BY X IRRADIATION OF P-N BARRIER LAYERS. Hans Pfister (Siemens-Schuckert Werke AG, Erlangen, Ger.). Z. Angew Phys., 15: 407-10(May 1963). (In German)

A measurement method is described, which is used to determine the x-ray-induced p-n transitions and diffusion length as well as the average energy requirements for formation of electron-cavity pairs. It is necessary for irradiation with monochromatic x radiation at two different wavelengths to measure the ratio of the striking radiation to the short-circuit current of the barrier-layer elements. By irradiation of a silicon p-n crystal with Mo–K_α and Ag–K_α radiation the diffusion length of electrons in the basic material was determined, and a value of 3.67 ± 0.24 ev was obtained for the average energy of electron-

cavity pair formation. For irradiation with the softer $Cr-K_\alpha$ and $Fe-K_\alpha$ radiation a value of 3.63 ± 0.1 ev was determined for the energy requirement. (tr-auth)

27933 THE EFFECTS OF GAMMA-RADIATION ON POLYAMID FILMS AND FIBERS PRODUCED IN POLAND. A. Országh and J. Zurakowska-Országh (Inst. of Nuclear Research, Warsaw). IAEA Preprint CN-14/38. 20p. (In French)

To be published in Proceedings of the IAEA Conference on the Application of Large Radiation Sources in Industry, Salzburg, Austria, May 1963.

The effects of radiation on the physical and physicochemical properties of polyamide films and fibers produced by polymerization of ω-caprolactam were investigated. The irradiation was carried out in air, nitrogen atmosphere, and water. Techniques for changing certain properties of polyamide films and fibers through grafting with the help of various monomers were examined. The grafting was done by simultaneous irradiation of polyamides in the presence of monomer solutions in different proportions and in the after-effect at varying temperatures. For each specific monomer an attempt was made to find the technique that would give the highest degree of grafting in relation to dose employed. (auth)

27934 EFFECT OF GAMMA IRRADIATION ON NATURAL AND SYNTHETIC LATEXES. V. L. Karpov, D. M. Sandomirskii, V. G. Yurkevich, and N. M. Sergeev. IAEA Preprint CN-14/61. 17p. (In Russian)

To be published in Proceedings of the IAEA Conference on the Application of Large Radiation Sources in Industry, Salzburg, Austria, May 1963.

As compared with bulk rubber, rubber particles in latexes vulcanized by irradiation possess specific properties. The properties of synthetic latex particles vulcanized by gamma irradiation, and of the films obtained from them, differ from properties they acquire through other vulcanization techniques. Changes in the properties of latex (pH, surface tension, and viscosity) as a colloidal system under irradiation depend to a considerable extent upon the chemical nature of the rubber and on its derivation. Yields differ according to whether vulcanization is carried out by particle or bulk irradiation. Aging processes for such latexes and the films obtained from them differ from aging processes for nonvulcanized or sulfur vulcanized latexes. The radiation vulcanized products have increased stability. The properties of the vulcanized rubber in the latex were confirmed by data indicating high resolution nuclear magnetic resonance spectra. (auth)

27935 IMPROVEMENTS IN OR RELATING TO THE TREATMENT OF CELLULOSE FILM. (to Heberlein & Co., AG). British Patent 929,204. June 19, 1963. Priority date Mar. 28, 1960, Switzerland.

A process is given for treating regenerated cellulose film for improvement of its mechanical properties, e.g., swelling in water and tear resistance. The process comprises irradiating the film with 10^3 to 10^7 rad of ionizing radiation. Crosslinking of the film is effected by this process without the need of heating or absence of oxygen. (D.L.C.)

PHYSICS

General and Miscellaneous

27936 (AERE-M-1207) THE PRODUCTION OF MAGNETIC FIELDS BY SUPERCONDUCTORS. D. A. Watt (United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England). Apr. 1963. 27p.

Abstracts for forty papers on the properties of superconductors and their use in the production of magnetic fields (particularly fields exceeding 40 kgauss) are included. (D.C.W.)

27937 (AID-62-155) NUCLEAR EFFECTS ON THE PROPAGATION OF ELECTROMAGNETIC WAVES. ANNOTATED BIBLIOGRAPHY. (Library of Congress. Aerospace Information Div., Washington, D. C.). Oct. 1, 1962. 30p. (AD-285328)

Abstracts are included for 114 articles on various aspects of particle and radiation behavior in the ionosphere and in plasmas, geomagnetic storms, radio wave transmission through the ionosphere, cosmic radiation, auroral storms, radio-emission by nuclear explosions, effects of nuclear explosions, solar radio-emission, and other related topics. (D.C.W.)

27938 (BNL-6396) STATISTICAL PROPERTIES OF SPECTRA. C. E. Porter (Brookhaven National Lab., Upton, N. Y.). [Sept. 14, 1962]. Contract [AT(30-2)-Gen-16]. 42p.

A brief review of the statistical properties of spectra is presented. The origin of spectral properties and the average properties and fluctuations of spectra are discussed. (auth)

27939 (JINR-P-1261) BYVOD URAVNENII RELYATIVISTSKOI GIDRODINAMIKI IE RELYATIVISTSKOGO KNIETICHESKOGO URAVNENIYA. (A Derivation of Relativistic Hydrodynamic Equations from Relativistic Kinetic Equation). N. A. Chernikov (Joint Inst. for Nuclear Research, Dubna, U.S.S.R. Lab. of Theoretical Physics). 1963. 7p.

Relativistic hydrodynamic equations for dissipative processes occurring in a gas are derived from the relativistic kinetic equation previously obtained. In the relativistic case the previously unknown dependence of the heat conductivity and viscosity coefficients on the local temperature and on the differential cross section of the gas particle interaction was found. Einstein gravitational phenomena were taken into account both in the kinetic and hydrodynamic equations. (auth)

27940 (LA-2877) LENS DESIGNING TECHNIQUE WITH THE 1962 LASL CODE FOR THE IBM 7090. Berlyn Brixner (Los Alamos Scientific Lab., N. Mex.). Mar. 22, 1963. Contract W-7405-eng-36. 47p.

A detailed instruction manual is given for users of the 1962 LASL lens design code, which is a general-purpose computing program for the evaluation and automatic design of optical lens and/or mirror systems with surfaces generated by conic sections. Described in relation to the program are IBM-7090 machine operations, prescription parameters, ray-tracing parameters, weights on lens performance, lens-parameter substitutions, increments to lens parameters, designing instructions, and parameter interactions. The sample calculation for a Lister-type lens is given in great detail. The general procedure used to design a special-purpose zoom lens is given, along with the final lens prescription and the performance characteristics. (auth)

27941 (NASA-TN-D-1756) SATELLITE OBSERVATIONS OF THE EQUATORIAL IONOSPHERE. L. J. Blumle (National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.). June 1963. 8p.

A method is presented for measuring total electron content by observing the Faraday effect on satellite beacon transmitters at a station located on the magnetic equator. This method is applied to data observed at Huancayo, Peru, between September 1961 and February 1962. The total electron content at the magnetic equator was found to have nearly a 10 to 1 diurnal variation with a maximum of 4×10^{17} electrons/m^2 near 1500 hours. Values of the thickness parameter $(\int Ndh)/N_{max}$ for the observational period show an anomalous increase around layer sunrise that is attributed to a departure from thermal equilibrium. (auth)

27942 (NIRL/R/32) THEORETICAL AND EXPERIMENTAL ASPECTS OF SUPERCONDUCTING COIL PROTECTION. P. F. Smith, G. P. Haskell, J. D. Lewin, A. H. Spurway, C. Jackson, and A. R. Kimber (Gt. Brit. National Inst. for Research in Nuclear Science. Rutherford High Energy Lab., Chilton, Berks, England). Feb. 1963. 26p.

Large superconducting coils require protection against overheating or voltage breakdown during a transition to the normal state. The basic theory of a number of protection techniques is summarized. Experimental measurements of the allowable energy dissipation in Nb–Zr wire, the decay times of Nb–Zr coils, and the shapes of current decay curves, support the main conclusions of the theory. Random variations in the observed decay curves appear to indicate an initial variable acceleration of the transition velocity. The maximum fraction of the stored energy that can be dissipated outside the cryostat is estimated theoretically. Some brief comments on protection using copper coated wire are included. (auth)

27943 (NP-12903) A DIRECT METHOD FOR MEASURING LIFETIMES OF EXCITED ATOMIC STATES AND ITS APPLICATION TO HELIUM (thesis). Thomas M. Holzberlein (Oklahoma. Univ., Norman. Research Inst.). May 1963. Contract AF 49(638)-639. 127p.

Apparatus, procedure, and theory associated with a direct method for measuring the lifetimes of excited atomic states are discussed; schematics of the electrical circuitry are included. The nature of the data, and its analysis, are illustrated. Some data taken for atomic He are also displayed. (D.C.W.)

27944 (NP-12908) CURRENT-CARRYING CAPACITY OF HIGH FIELD SUPERCONDUCTING SOLENOIDS. Scientific Paper 62-128-282-P2. B. S. Chandrasekhar and J. K. Hulm (Westinghouse Electric Corp. Research Labs., Pittsburgh). Oct. 30, 1962. 6p.

The relation between the field H and the diamagnetically induced current I_ϕ which is supposed to account for the degradation of critical current when Nb–Zr wire is formed into a solenoid, is examined. It is asserted that the relation will depend upon the reversible magnetization contribution; such a relation is proposed and discussed. (D.C.W.)

27945 (NP-12936) IGNITION OF MATERIALS BY LARGE YIELD NUCLEAR WEAPONS FOR VARIOUS BURST HEIGHTS AND ATMOSPHERIC CONDITIONS.

Jack C. Rogers (Stanford Research Inst., Menlo Park, Calif.). May 1963. 36p.

Selected unclassified results on thermal effects of nuclear detonations are summarized. The expected ranges are given for ignition of materials by megaton weapons under the assumption of an idealized, transparent atmosphere. From these similar results are developed for real atmospheres. The effects of altitude variation on ignition radii are explored, including surface and outer space bursts. Attenuation of clouds is considered, as well as bursts below clouds and the influence of ground snow cover on the ignition ranges. Recommended research, which would improve some of the estimates of ignition range, is outlined. (auth)

27946 (NP-12937) ELECTROLUMINESCENCE: AN ANNOTATED BIBLIOGRAPHY. Peter R. Stromer, comp. (Lockheed Missiles & Space Co., Sunnyvale, Calif.). June 1963. 122p. (SB-63-6)

References (263) are given to reports and U. S. and foreign journals and patents published from 1956 through December 1962. Both types of electroluminescence, carrier injection (provided by direct current) and intrinsic (alternating current), are included. Separate corporate, author, and subject indexes are included. (P.C.H.)

27947 (TID-18816) THE CONVERSION OF ELECTROMAGNETIC ENERGY INTO SHOCK PULSES. T. F. Meagher (Sandia Corp. Livermore Lab., Livermore, Calif.). May 1963. Contract [AT(29-1)-789]. 25p. (SCDC-2046)

The repulsion-coil technique for energy conversion offers a powerful, new tool in the field of acceleration testing. Using this technique, a prototype magnetic shock device was developed that uses electrical energy stored in a capacitor bank to produce high-g, mechanical acceleration pulses. A disc projectile is vacuum-held against the core of an electromagnet coil, and a crystal accelerometer is attached to the projectile to monitor the pulse. The capacitor bank is charged to a specific voltage between one and 20 kv, then discharged into the coil. The resultant magnetic field around the coil effects a repulsion of the projectile, which is mechanically free to move away from the coil. By varying the capacitor voltage, the magnitude of the pulse can be predicted and controlled. The application of electrical-energy conversion in the production of a controllable acceleration pulse toward development of a magnetic shock device for component testing and instrument calibration is demonstrated. (auth)

27948 (TID-18921) THE SPECTRUM, THE EXCITATION AND IONIZATION CROSS-SECTIONS FOR PHOTO PROCESSES AND FOR COLLISIONS, OF FIVE TIMES IONIZED OXYGEN. Quarterly Report No. 8, March 1, 1963 to May 31, 1963. Carlos M. Varsavsky (P.E.C. Corp., Boulder, Colo.). Contract AT(11-1)-1017. 58p.

The survey of available atomic data on O(VI) was completed by examining the cross sections for excitation and ionization by electron impact. Excitation cross sections were calculated by the semi-classical symmetrized impact parameter (IP), Coulomb-Bethe, and Coulomb-Born approximations. Classical theory was found to give reliable estimates for ionization cross sections; while the IP method, inapplicable to ionization, works well for excitation. Photoionization cross sections calculated for O(VI) are presented. Tables of matrix elements that enter into the calculation of photoionization cross sections as functions of n, l, z, z, and incident energy are also included. (D.C.W.)

27949 (UCRL-10769) PHASE SHIFT ANALYSIS OF HEAVY ION SCATTERING. H. E. Conzett, A. Isoya, and E. Hadjimichael (California. Univ., Berkeley. Lawrence Radiation Lab.). Apr. 1963. Contract W-7405-eng-48. 13p.

Optical model and phase shift analyses are shown to be equivalent for the elastic scattering of strongly absorbed particles if the phase-shift parameterization is proper. The parameterization is examined, and the results of a phase shift analysis of C^{12} + Ta scattering data are given. Advantages of the phase-shift analysis are also pointed out. (D.C.W.)

27950 (UCRL-10802) THE EXCITATION AND LORENTZ IONIZATION OF 10-Mev HYDROGEN ATOMS. Klaus H. Berkner, John R. Hiskes, Selig N. Kaplan, George A. Paulikas, and Robert V. Pyle (California. Univ., Berkeley. Lawrence Radiation Lab.). June 19, 1963. Contract W-7405-eng-48. 16p.

The populations of excited states with principal quantum numbers n = 6 through n = 9 were measured for 10-Mev hydrogen atoms produced by gas-collisional breakup of H_2^+. The fractional populations are approximately $2/n^3$ to $3/n^3$. Similar measurements were made for 20-Mev deuterium atoms produced by gas-collisional electron detachment of D^-. The excited atoms were detected by a magnetic-field Lorentz ionization experiment. The detachment as a function of magnetic field agrees well with the calculations of Rice and Good for the limiting fields of each n level, and is compatible with a statistical distribution of states within a given principal quantum level. Excitation by nonionizing collisions was observed by Lorentz stripping some of the higher levels of an atomic-hydrogen beam before passing the beam through a gas cell, and observing subsequent repopulations of the stripped levels. The results agree qualitatively with extrapolations of calculations by Milford. (auth)

27951 (AEC-tr-5850) A NEW EFFECT AT THE INITIATION OF SUPERCONDUCTIVITY. W. Meissner and R. Ochsenfeld. Translated for Ames Lab., Ames, Iowa from Naturwissenschaften, 21: 787-8(1933). 2p.

Placing a cylindrical superconducting material, such as Pb or Sn, above its transition point into a homogeneous magnetic field oriented vertically to its axis and lowering its temperature below the transition point was found to change the distribution of force lines outside the superconductor to that expected for zero permeability and a diamagnetic susceptibility of $-\frac{1}{4}$ of the superconductor. The magnetic field in the interior of the tube remains as it was above the transition point, even though the external field is altered. Passage of an external current through parallel superconductors connected in series, followed by passage to a temperature below the transition point, resulted in an increase in the magnetic flux between the superconductors. (D.C.W.)

27952 (UCRL-Trans-957(L)) ON THE QUESTION OF MEASURABILITY OF ELECTROMAGNETIC FIELD QUANTITIES. N. Bohr and L. Rosenfeld. Translated for Univ. of California Lawrence Radiation Lab., Livermore from Kgl. Danske Videnskab. Selskab, Mat. Fys. Medd., 12: 1-65(1933). 47p.

Considerations affecting the measurability of field quantities (uncertainties, effects of test body acceleration, etc.) are examined, and the use of field measurements to test the predictions of the quantum electromagnetic formalism is investigated. It is concluded that the quantum theory of fields represents a self-consistent idealization in respect

to the question of measurability to such an extent that all limitations that rest on the atomic structure of the field sources and the measuring instruments can be ignored. (D.C.W.)

27953 THE SCATTERING OF X-RAYS BY N_2. G. E. Kilby (Sheffield Univ., Eng.). Acta Cryst., 16: 476-9 (June 10, 1963). (In English)

The wave function of Scherr was employed to calculate the coherent x-ray scattering from N_2. Two alternative procedures are discussed, the first based on a three-center representation of the charge cloud, the second based on a one-center expansion in spherical harmonics following Banyard & March. It is found that the scattering obtained from Scherr's electron density differs only slightly from that given by forming the molecular density as a superposition of two N atoms. The incoherent scattered intensity is estimated from Freeman's work on atoms and the final total intensity is compared with the experimental results of Gajewski. There is a large discrepancy and it is concluded that the wave function of Scherr leads to a density in which insufficient account of bonding is included. (auth)

27954 SYMPOSIUM ON THERMIONIC POWER CONVERSION, COLORADO SPRINGS, COLORADO, 1962. Sessions IV-VII. Paul H. Egli, ed. Advanced Energy Conversion, 3: 1-405(Jan.-Mar. 1963).

Separate abstracts were prepared for thirty-four of the forty papers on thermionic-cell design and performance, phenomena associated with thermionic cells, and studies of materials for thermionic cells. Three of the remaining papers were previously abstracted for NSA. (D.C.W.)

27955 COLLISION PROBABILITY OF LOW ENERGY ELECTRONS WITH CESIUM ATOMS. R. K. Flavin and R. G. Meyerand, Jr. (United Aircraft Corp., East Hartford, Conn.). Advanced Energy Conversion, 3: 3-18(Jan.-Mar. 1963).

The collision frequency for momentum transfer of low energy electrons with cesium atoms was determined from measurements of the microwave cyclotron resonance absorption and radiation spectra of a cesium plasma in a d-c magnetic field. In accordance with theory, the spectral line shape was found to vary linearly with pressure affording a measure of the collision cross section and the velocity dependence of the collision frequency. The experiment was conducted to measure the collision cross section for electron energies of 0.05 – 0.06 ev in the cesium pressure range of 100 – 500 μ Hg. Electrons are created in an rf breakdown of cesium vapor external to a waveguide measurement cell and allowed to drift along a d-c magnetic field that is perpendicular to the direction of microwave propagation. Before entering the waveguide measurement cell, the electrons become thermalized at the gas temperature due to the numerous collisions that they suffer with cesium atoms. All microwave measurements were made with electron densities less than $10^8/cm^3$ to insure that plasma resonance effects are negligible. The discussion of the experiment includes a description of the X-band microwave spectrometer incorporating phase detection and the double oven housing the cesium tube and measurement cell in the d-c magnetic field. Experimental and theoretical assumptions are reviewed; and cross section values for P_c = 166 to 179 (cm^{-1} mm Hg^{-1}) at 0.05 and 0.06 ev, respectively, are reported. The velocity dependence of the cross section in the energy range investigated was compared to the velocity dependence indicated by the spectral line shape, and the two methods are discussed. The cross section values obtained are compared to previous data in the literature. (auth)

27956 THERMODYNAMIC AND TRANSPORT PROPERTIES OF A CESIUM PLASMA. L. B. Robinson (Univ. of California, Los Angeles). Advanced Energy Conversion, 3: 19-36(Jan.-Mar. 1963).

Thermodynamic and transport properties of partially ionized Cs vapor, or plasma, are determined from theory (supplemented by available experimental results). Thermodynamic properties are derived by considering the vapor as a Lennard-Jones gas. The effects of electrons and ions on the vapor properties are considered; and numerical values are given for entropy, internal energy, heat capacity at constant pressure, and enthalpy. Transport properties are obtained from solutions of the Boltzmann transport equation involving the familiar collision integrals of Chapman and Cowling and of Hirshfelder, Curtiss, and Bird. Numerical values for the electron collision frequency, thermal conductivity, diffusion coefficient, and viscosity are given. The collision frequency between electrons and neutral atoms is obtained from quantum mechanical considerations. The results of the calculation are compared with experimental evidence. (auth)

27957 THERMAL CONDUCTIVITY OF CESIUM VAPOR. Milton Gottlieb and R. J. Zollweg (Westinghouse Electric Co., Pittsburgh). Advanced Energy Conversion, 3: 37-48(Jan.-Mar. 1963).

The thermal conductivity of cesium vapor was measured as a function of pressure at spacings that correspond to a range from a fraction of a cesium mean free path to several mean free paths. The gas conduction was measured as the increase in power necessary to maintain a hot ribbon filament at a fixed temperature with increasing cesium pressure. A differential measurement with two filaments of different lengths was used to cancel end errors, so that a high degree of accuracy was achieved. The thermal conductivity is independent of spacing at low cesium pressures and is a constant, independent of pressure at high pressure, as expected from kinetic theory. A value of 1.7×10^{-3} W/cm-°K was obtained for this high pressure limit. (auth)

27958 THEORETICAL CALCULATION OF THE THERMAL CONDUCTIVITY OF CESIUM VAPOR AT THERMIONIC TEMPERATURES. W. R. Martini (Atomics International, Canoga Park, Calif.). Advanced Energy Conversion, 3: 49-58(Jan.-Mar. 1963).

The heat conducted between the emitter and the collector of a thermionic diode by cesium vapor is an important fraction of the total heat transport. Equations were developed for the thermal conductivity of cesium vapor based upon the kinetic theory of gases for high, very low and intermediate pressures. In order to apply these equations, the molecular diameter and the accommodation coefficient must be experimentally known. The possible ranges for these quantities are given. Since at the conditions existing in a thermionic diode cesium is a monatomic gas, the possibility of additional heat transport in the very low pressure (Knudsen) region by association to Cs_2 at the cold surface, or by emission of excited atoms or ions from the hot surface, was investigated. In most cases the thermal effect of association and of excited atom or ion emission was found to be very small. A simple procedure is described for measuring the thermal conductivity of cesium vapor in a functioning thermionic diode. Data obtained by the author are compared with kinetic theory and with results from other laboratories. Agreement between experiments and theory is within an order of magnitude and shows

that the phenomenon of heat transport through cesium gas requires additional investigation. (auth)

27959 EXPERIMENTAL DETERMINATION OF THE HEAT CONDUCTION OF CESIUM GAS. S. Kitrilakis and M. Meeker (Thermo Electron Engineering Corp., Waltham, Mass.). Advanced Energy Conversion, 3: 59-68(Jan.-Mar. 1963).

The heat conduction of a cesium gas in a thermionic diode was found by measuring under open circuit conditions the difference in heat flux rejected from the diode collector in the presence and absence of cesium vapor. Different emitter materials and emitter temperatures were employed, as well as different spacings. The measurements were made for a range of pressures that extended from regions where the gas mean free path is long compared to the interelectrode spacing to regions where the mean free path becomes small. The observed dependence of heat conduction with pressure was correlated with theoretical predictions resulting in an estimation of the accommodation coefficient of the gas. The heat conduction at high pressures corresponded to a cesium gas thermal conductivity that varies from 4.5 to 6.3×10^{-5} W/cm°K, as the mean gas temperatures vary from 1100 to 1400°K. The temperature dependence of the thermal conductivity was examined, first assuming a gas of smooth elastic spherical particles and then an identical gas but with an added force between atoms which acts at a distance. Both these models explain only the gross features of the temperature dependence of the thermal conductivity. (auth)

27960 SOME CRITICAL MATERIALS PROBLEMS OF THERMIONIC CATHODE SYSTEMS FOR FISSION-HEAT CONVERSION. L. Yang, R. G. Hudson, F. D. Carpenter, and A. F. Weinberg (General Atomic Div., General Dynamics Corp., San Diego, Calif.). Advanced Energy Conversion, 3: 93-9(Jan.-Mar. 1963).

Out-pile problems associated with the two types of thermionic emitters considered for direct conversion of fission heat to electrical energy are analyzed. For the carbide-cathode systems (particularly, UC–ZrC) composed of uranium-bearing carbides to serve as the fission-heat source as well as the emitter, loss of cathode materials by vaporization at useful temperatures is the greatest obstacle. For the metal-cathode systems, interaction between the refractory-metal emitter surrounding the uranium-bearing fuel is of chief concern. The feasibility and status of the two systems are also discussed. (D.C.W.)

27961 INTERDIFFUSION BETWEEN URANIUM-BEARING REACTOR FUELS AND REFRACTORY-METAL THERMIONIC EMITTERS. A. F. Weinberg and L. Yang (General Atomic Div., General Dynamics Corp., San Diego, Calif.). Advanced Energy Conversion, 3: 101-11(Jan.-Mar. 1963).

Material compatibility as related to the "marriage" of reactor fuels to refractory metal thermionic emitters is under investigation. Four fuel materials, UC, UC_2, UC-ZrC, and UO_2, are studied in combination with W, Mo, Ta, and Nb over the temperature range 1200 to 2000°C. A technique was developed for simultaneously studying the interdiffusion between a given uranium-bearing material and each of the four refractory metals. UC in contact with Nb and Ta at 1875° ± 20°C and 1925 ± 30°C, respectively, reacted to form a liquid phase identified as almost pure uranium metal. Mo also reacted with UC at 1800 ± 20°C, while at the same temperature W appeared relatively unaffected. However, after being contacted with UC at 2000° ± 20°C for 30 hr, W exhibited a mild reaction. The reaction mechanism for all of these metals appears to be UC + M = MC + U. Formation of this liquid phase was suppressed at 1800°C when UC-UC_2 mixtures were substituted for the UC. The kinetics of uniform metal carbide layer formation were studied for UC-UC_2 mixtures in contact with the four refractory metals at 1800°C. In addition to the uniform carbide layers formed, severe carbide penetration of the grain boundaries was observed in Nb, Ta, and Mo. Investigation of the interaction between UZrC (6.0 mole % U; 45.8 mole % Zr; 48.2 mole % C) and the same four refractory metals at 1800°C for 50 hr showed that the stabilization of the carbide phase by the addition of Zr dramatically improves the diffusion characteristics. Electron micro-probe analyses of these diffusion couples were made and the results are discussed. Preliminary investigations of UO_2-refractory metal compatibility were completed for three temperatures: 1200, 1800, and 2000°C. Indications of transport of one or more of the fuel components through grain boundaries were observed. (auth)

27962 THE DEVELOPMENT OF EMITTER MATERIALS FOR USE IN THE NOBLE GAS PLASMA DIODE. R. F. Hill (General Motors Corp., Warren, Mich.) and D. L. Keller. Advanced Energy Conversion, 3: 113-21(Jan.-Mar. 1963).

The operating characteristics of the noble gas plasma diode thermionic converter require that the emitter contain a high surface concentration of enriched uranium. The emitter materials were limited to uranium carbide of both the ceramic and cermet systems. The ceramic materials investigated were pure UC and the mixed carbide UC–ZrC. The cermet materials investigated were UC–Nb, UC–Mo, UC–W, and UC–Re. The chemical reactivity between the uranium carbide and the metal in the four-cermet systems varied quite markedly; the UC–Re system appearing to be the most stable one at 2000°K. A reference emitter material composed of 80 v/o UC–20 v/o Re was selected. The emitter discs were fabricated by the gas pressure bonding process. This process can be utilized to densify the core and simultaneously clad and bond the core into an integral assembly in a one-step operation. Results of the fabrication studies as well as some thermodynamic considerations for the cermet systems are presented. (auth)

27963 PROGRESS IN THE DEVELOPMENT OF FLAME-HEATED THERMIONIC POWER SOURCES. W. R. Martini and R. L. McKisson (Atomics International, Canoga Park, Calif.). Advanced Energy Conversion, 3: 123-36 (Jan.-Mar. 1963).

Due to the inherent high power-to-weight ratio of a thermionic diode, development of flame-heated diodes is being pursued for application to small, lightweight, silent power sources. To demonstrate that power could be obtained from a flame-heated cesium-vapor diode, a furnace was built using surface combustion in a bed of zirconia chips to heat a molybdenum emitter to 1500°C. The exterior of the emitter was coated with Durak-B, a protective layer of molybdenum disilicide, and in addition, a wafer of silicon carbide was used as a barrier between the flame and the coated molybdenum. Although the overall heating efficiency of the above externally heated diode and furnace was found to be low, it is shown that the heating efficiency can be improved considerably by using an internally heated diode. Some successful experiments of burners designed to fit inside a large thermionic diode are described. A prototype internally heated thermionic diode using a 1-in. I-D molybdenum thimble with an 84 cm^2 emitter area was constructed and tested using electrical heating. Pertinent details of its con-

struction and operation are described. In general, its performance was quite similar to that of our cylindrical diodes, with an observed 8 per cent conversion efficiency at a 1540°C emitter temperature. Plans for the future development of the flame-heated diode concept are briefly described. (auth)

27964 EMITTER CORROSION IN THERMIONIC CONVERTERS. R. L. McKisson (Atomics International, Canoga Park, Calif.). Advanced Energy Conversion, 3: 137-56 (Jan.-Mar. 1963).

It was observed that under certain circumstances a relatively large amount of material was transported from a molybdenum thermionic emitter to the collector. Because of the serious implications of this transfer on diode life, an analysis of the chemical system within a cesium diode was made. The various chemical species expected, and their interactions under various conditions, are described. It is shown that a gross transfer of molybdenum is not likely in a system having only oxygen as an impurity. However, if hydrogen is also present within the diode, a mechanism for gross transfer of molybdenum is established, and a serious transfer problem will be produced. The analysis is extended to consideration of other emitter metals. The external corrosion of the molybdenum emitter sheath is a major detriment to the use of a fossil fuel flame as a thermionic generator heat source. However, since a flame-heated thermionic generator appears to be an attractive solution for certain specialized military tasks, this corrosion problem is currently being examined. Various protective coatings for molybdenum are described and discussed. Experimental results of tests of the silicon-base Durak-B coating are presented and analyzed. (auth)

27965 A STUDY OF CESIUM VAPOR ATTACK ON THERMIONIC CONVERTER CONSTRUCTION MATERIALS. M. J. Slivka (General Electric Co., Schenectady, N. Y.). Advanced Energy Conversion, 3: 157-66(Jan.-Mar. 1963).

The rate of attack by cesium vapor on a number of ceramic, metallic and metal–ceramic seal materials considered for possible use in the construction of cesium vapor thermionic converters was studied to obtain data on which to select attack resistant materials for use in current thermionic converter work and to determine where concerted effort was needed and should be placed in more extensive attack rate experiments to follow. A description is given of a test vessel having an integral cesium source in which the attack experiments were conducted, as well as the processing and testing procedures that were followed. A considerable variation of attack rates was observed for various commercial and proprietary ceramic bodies between 600 and 900°C. What appears to be an anomalous variation in the attack rate with temperature was also observed for certain ceramic bodies. Photomicrographs are presented showing the results of attack on a variety of metallic materials of interest at 900°C along with similar results on representative active-alloy metal–ceramic seals. A brief description will be given of a program that is under way to investigate those areas determined to be in need of additional study, along with any pertinent early results obtained. (auth)

27966 PHYSICOCHEMICAL PROPERTIES OF BORIDE THERMIONIC CATHODE MATERIALS. A. I. Kaznoff, E. W. Hoyt, and L. N. Grossman (General Electric Co., Pleasanton, Calif.). Advanced Energy Conversion, 3: 167-73(Jan.-Mar. 1963).

Lanthanide hexaborides have been shown to cover a wide range of thermionic work functions. This range covers the span of 2.2 to 4.9 ev. The materials problems encountered in working with these emitter materials are discussed. The materials studied were YB_6 and EuB_6, the first having the lowest reported work function of the hexaborides (2.2 ev), the second having the highest work function (4.9 ev). The following topics are discussed: synthesis of the hexaborides, fabrication of the hexaborides, bonding of the hexaborides to refractory metal substrates, sublimation behavior at high temperatures and decomposition products, and compatibility of the hexaborides with cesium. Physicochemical properties of YB_6 and EuB_6 are also summarized. (auth)

27967 THE EVAPORATION OF MOLYBDENUM IN THE PRESENCE OF CESIUM VAPOR. L. S. Richardson, Milton Gottlieb, and R. J. Zollweg (Westinghouse Electric Corp., Pittsburgh). Advanced Energy Conversion, 3: 175-84(Jan.-Mar. 1963).

Initial measurements of the deposition of molybdenum from a molybdenum cathode onto a nickel anode in the presence of cesium vapor showed a significant reduction over that for vacuum evaporation. The ribbon filament in these experiments was heated electrically and the quantity of deposited molybdenum determined by spectro-chemical analysis. Four cathode-anode spacings were provided to determine the dependence of the deposit on spacing. These initial results were refined and extended to cover a larger range of emitter temperatures and cesium pressures. The data were fitted to $R_v/R = 1 + apd$ where the left side is the ratio of deposition in vacuum to that in cesium vapor, p is the pressure and d the spacing with a equal to 0.06 mm. $Hg^{-1}\ \mu^{-1}$. Over the limited range of cesium coverage of these experiments any enhancement of molybdenum evaporation because of the cesium coverage was small, and no whisker growth caused by returned molybdenum was detected. (auth)

27968 ANALYSES OF THE CHEMICAL REGENERATION OF SUBLIMATING THERMIONIC COMPONENTS. L. K. Tower (Lewis Research Center, Cleveland). Advanced Energy Conversion, 3: 185-98(Jan.-Mar. 1963).

The process of chemical regeneration of hot metallic surfaces, which may find application in very high temperature thermionic devices, is discussed. In the process, gaseous materials such as chlorine form compounds with the metal departing from the hot emitter surface. The metallic compounds return the metal to the emitter surface where it is redeposited. An analysis of chemical regeneration under conditions of free molecule flow (Knudsen conditions) in which particles are assumed not to interact in the interspace is presented. Partial or complete equilibration is assumed at the walls, the degree of equilibration being expressed by a recombination coefficient, γ. The analysis prescribes conditions within the system required to prevent destruction of the surfaces. A simplification of the analysis yields a thermodynamic criterion for selection of materials to be tested in regenerative systems. Hypothetical systems considered as examples are: W–Cl, Mo–Cl, W–Mo–Cl, and W–O. The possible difficulty in constructing a stable device with an emitter and collector of the same material is discussed, together with a solution to the problem. (auth)

27969 URANIUM CARBIDE AS A THERMIONIC EMITTER. A. D. Elcombe and D. A. Wright (Univ. of Durham, Eng.). Advanced Energy Conversion, 3: 199-202 (Jan.-Mar. 1963).

The properties of uranium carbide as a thermionic emitter were studied in vacuum diodes. The cathodes were tantalum strips coated with a layer of uranium carbide about

1/10 mm thick. The carbide contained excess carbon and was applied to the strip over a thin sintered layer of tungsten powder, which was used to improve adhesion. Water cooled copper anodes were employed. Richardson plot analysis showed that the initial properties were characterized by a work function ϕ of 3.9 ev, and an A value of 20,000. Activation occurred during operation at 2000°K for about 50 hr, leading to a peak performance represented by $\phi = 3.3$ ev, $A = 200$. After operation at 2000°K for 180 hr drawing 1 A/cm^2, the emission fell to half this value, leading to a state with $\phi = 4.6$ ev, A greater than 10^5. It is probable therefore that there is little if any uranium carbide remaining on the cathode at this stage. Further analysis of the Richardson plots showed temperature-hysteresis effects. With the coating in its early stages of activation the behavior resembles that of various complex cathodes, and suggests the presence of an adsorbed layer on the surface, which lowers the work function, the coverage of this layer depending on diffusion from within the coating and evaporation from it. Different states can therefore be "frozen in" at low temperatures depending on the treatment at higher temperatures. It is possible that this effect is due to dissociation, the diffusing active material being free uranium. In the highwork function states there is evidence of high coating resistance. Such effects could explain both the hysteresis and the high Richardson plot A values, since internal concentration and surface coverage could both be temperature dependent, causing a temperature dependence of the work function. (auth)

27970 CESIUM ADSORPTION ON REFRACTORY METALS. A. J. Kennedy (Martin Marietta Corp., Baltimore). Advanced Energy Conversion, 3: 207-21(Jan.-Mar. 1963).

The measurement of the effective work function of a cesium-covered emitter as a function of emitter temperature and cesium pressure provides an important insight into the adsorption phenomena. Experimental data on the work function of tantalum, molybdenum, rhenium, iridium and other refractory metals, over a range of emitter temperature (1500–2000°K) and cesium pressures (0.01–3 mm Hg), are presented. A model of the adsorption process, in good agreement with the trends shown by the data, is also given. (auth)

27971 EXPERIMENTAL EVIDENCE FOR CYCLIC AND SPONTANEOUS MIGRATION OF CESIUM ON RHENIUM AND TUNGSTEN. G. J. Daly and J. L. Gumnick (Martin Marietta Corp., Baltimore). Advanced Energy Conversion, 3: 223-7(Jan.-Mar. 1963).

The effect of cesium on the field emission characteristics of rhenium and tungsten was studied using a field emission microscope. Cesium was deposited on the emitters after measurements were made on them in their clean state. The work function of each changed from that associated with the clean metal to that of metallic cesium when several monolayers of cesium were allowed to contaminate the emitting surface. For both rhenium and tungsten there was no radical change in the symmetry of the emission pattern due to cesium adsorption. There was, however, evidence for build up at low work function planes and at plane edges. When voltages in the range of 1500–3800 V were applied, a spontaneous initial migration of cesium was observed starting at the low work function regions of the emitter. The minimum starting voltage for this migration was lower for tungsten than for rhenium and was dependent upon cesium pressure in the tube. The migration was very roughly circular moving toward the edge of the emission pattern. After a time lapse of several seconds, migration proceeded from the pattern periphery back toward the center. The effect was like a contracting ring of brightness that stopped at a certain minimum size then reversed moving again to the periphery of the pattern. The expansion and contraction of this ring repeated itself in cycles with periods of the order of ten seconds. Associated with this migration were fluctuations of emission current at constant voltage ranging from two to ten times the base current on which they were superimposed. The shapes of current versus time wave forms of the cyclic activity were almost identical over periods of several minutes, but showed slight continuous changes over longer periods of time. (auth)

27972 EXPERIMENTAL STUDIES OF LOW-WORK-FUNCTION COLLECTORS. R. A. Missman and B. L. Gehman (General Atomic Div., General Dynamics Corp., San Diego, Calif.). Advanced Energy Conversion, 3: 229-33(Jan.-Mar. 1963).

Thermionic emission from a cesium-covered molybdenum surface is increased by the introduction of hydrogen. Emission in the presence of cesium hydride is about two orders of magnitude larger at 500°K than is obtained with cesium alone. The lower work function obtainable with cesium hydride may be useful for providing a low work function collecting surface in a thermionic converter if means can be found to retain the required amounts of cesium, cesium hydride, and hydrogen under operating conditions. (auth)

27973 EXPERIMENTAL STUDIES OF Cs–CsF–Mo AND Cs–CsF–W PLASMA DIODE EMITTERS. W. A. Ranken, R. L. Aamodt, L. J. Brown, and B. D. Nichols (Los Alamos Scientific Lab., N. Mex.). Advanced Energy Conversion, 3: 235-44(Jan.-Mar. 1963).

Measurements are presented which demonstrate that the electron emission of molybdenum in cesium vapor is greatly enhanced by the addition of cesium fluoride. This enhancement amounts to a factor of about 340 at the maxima of the respective Langmuir S-curves for a cesium pressure of 10^{-2} mm Hg. The minimum effective work function of the Cs–CsF–Mo surface is 1.38 ± 0.05 ev. Preliminary measurements of the work function of cesium fluoride coated tungsten were made by obtaining retarding potential curves for photo electrons liberated from the cesium fluoride coated tube wall by an external light source. An activation process is indicated by the fact that it is necessary to heat the tungsten wire to about 1100°K in order to obtain a high work function surface. A Cs–CsF–W emitter was incorporated into a plasma cell of unguarded parallel plate design. At the initial emitter–collector spacing of 0.25 in. attempts to operate the cell in the low voltage arc regime met with little success, although some cross over into the useful power section of the current–voltage characteristic occurs for a cesium pressure of 0.1 mm Hg and emitter temperatures in the region about 1900°K. Arc currents extrapolated to zero voltage indicate that the emission of the Cs–CsF–W emitter is about the same as that from a Cs–CsF–Mo emitter. (auth)

27974 IONIZATION OF CESIUM AT SURFACES. W. B. Nottingham (Massachusetts Inst. of Tech., Cambridge). Advanced Energy Conversion, 3: 245-53(Jan.-Mar. 1963).

Indications from voltage–current curves of thermionic power converters suggest enhanced ionization at, or very near, cesium-coated surfaces. Experiments are now being conducted to study this phenomenon quantitatively. The tube contains three indirectly-heated tantalum surfaces surrounded by a shield. These heated surfaces are tantalum tubes located at the three corners of an equilateral trian-

gle. The extension of a line from the corner E1 perpendicular to the base of the triangle formed by the line E2 and E3 serves to locate the position of a fine-wire ion collector. Electrons are accelerated from surfaces E2 and E3 to bombard E1. Ions produced at or near E1 are then accelerated toward the ion collector to serve as a measure of the ion production. Results of this experiment are discussed in detail. (auth)

27975 WORK FUNCTION MEASUREMENTS IN EXPERIMENTAL TUBES CONTAINING CATHODES OF URANIUM AND ZIRCONIUM CARBIDES. B. J. Hopkins, K. J. Ross, and B. H. Blott (Southampton Univ., Eng.). Advanced Energy Conversion, 3: 265-71(Jan.-Mar. 1963).

Work function measurements are reported for carburized tantalum cathodes coated electrophoretically with uranium and zirconium carbides. Thermionic methods for the determination of work function were used together with the Zisman modification of the Kelvin technique. The poor agreement found between the two sets of results is thought to indicate that thermionic emission takes place from only a fraction of the total cathode area. Work function measurements were also made on the thin films that evaporate from these cathodes during their operation at high temperatures on to fixed anodes. When the cathode is uranium carbide, our measurements can be interpreted in terms of an evaporated film of uranium metal and uranium monoxide on the anode surface. All of this work was performed under ultra-high vacuum conditions. The mean work function values for tubes containing uranium carbide cathodes are as follows: the work function from the Kelvin measurements at 300°K is 3.81 ± 0.01 ev and that from the slope of a Richardson line plotted from retarding field data and applying to 0°K is 2.9 ± 0.1 ev. The temperature coefficient of the work function of uranium carbide is 5×10^{-4} ev per deg. For zirconium carbide cathodes the mean values are: 3.62 ± 0.01, 2.5 ± 0.1 ev, and 7×10^{-4} ev per deg. The work function of the anode in a tube containing a uranium carbide cathode reaches a constant value in a few hours of 3.0 ± 0.1 ev. This, like the Kelvin results quoted above, is an arithmetic average over the area of any high and low work function patches and in this case applied to the unmeasured temperature of the anode when the cathode was operating at 1300°K. (auth)

27976 THERMIONIC PROPERTIES OF UC, UC–ZrC AND Ta. K. F. Bainton (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Advanced Energy Conversion, 3: 273-7(Jan.-Mar. 1963).

Using planar diode geometry and long pulse measuring techniques, a study was made of thermionic emission from samples of UC, UC–ZrC and Ta. Richardson constants deduced for UC (A 55.5 ϕ 3.11) and Ta (A 47.1 ϕ 4.12) are in fair agreement with values obtained by other investigators. The emission from a UC–ZrC solid solution (A 0.44 ϕ 2.69) was less than that previously reported. (auth)

27977 THERMIONIC EMISSION FROM ZIRCONIUM CARBIDE WITH CAESIUM VAPOUR PRESENT. J. Myatt (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Advanced Energy Conversion, 3: 279-85(Jan.-Mar. 1963).

Measurements of electron emission from ZrC, both under high vacuum conditions and in an atmosphere of cesium vapor, are presented. Under vacuum conditions the following emission constants were determined: $A = 3.03 \times 10^4$ A/cm^2 °K^2 and $\phi = 4.48$ ev. Cesium was found to increase this emission by a factor of 10^4 at low emitter temperatures. Langmuir type S curves were observed, but even at the highest temperatures reached (1920°K) the emission was still a factor of 8–10 times greater than from the clean ZrC. (auth)

27978 STUDY OF THERMOEMISSIVE PROPERTIES OF URANIUM CARBIDES BY AN EMISSION ELECTRON MICROSCOPE. B. Devin, G. Gayte, L. Koch, and L. Sondaar (CEN, Saclay, France). Advanced Energy Conversion, 3: 287-94(Jan.-Mar. 1963).

The image of the electron emission of uranium carbide is obtained in an experimental microscope in which the object to be studied is heated to emission temperature by electron bombardment. The tests were performed on disks obtained by sintering or by fusion. The difference of emission between the various elementary crystals depends upon the crystalline orientation of the face considered. It is possible to measure the difference between the work functions and to relate this to the orientation of the surface plane. The method enables one to see the influence of surface impurities (e.g.: O_2, UO_2) and to observe the evolution of grains boundaries during heating. (auth)

27979 SPECTRAL EMISSIVITIES OF ELECTRODE MATERIALS. J. R. Branstetter (Lewis Research Center, Cleveland). Advanced Energy Conversion, 3: 295-303 (Jan.-Mar. 1963).

Many of the high temperature metals and carbides being considered as electrodes in thermionic convertors possess spectral emissivities that are sensitive to both wavelength and temperature. For these materials the gray-body procedure for computing the net radiant heat exchange can yield results considerably different from those obtained by the more exact method of summing the monochromatic heat flux over several hundred increments of wavelength. For tungsten, the flux obtained by summation has been shown to be as much as 25 per cent greater than the gray-body flux when both computational procedures were based on the same emissivity data. Current progress towards obtaining spectral emissivity data on other materials (such as tantalum) is discussed along with the amount of emissivity data required for any given material in order to calculate summed net heat flows having good accuracy and the extent to which simple equations can be made to fit these heat flow data. The analytical procedure used by the NASA data-reduction center to compute net heat flux for particular geometries is mentioned. Emphasis is placed on how the procedure can be applied to a variety of geometries and materials. (auth)

27980 THE THEORY OF GAS DISCHARGES WITH EXTRANEOUS ION SUPPLY. D. Gabor (Imperial Coll. of Science and Tech., London). Advanced Energy Conversion, 3: 307-14(Jan.-Mar. 1963).

It was suspected for some time that the ion current J_i required for establishing a cathode sheath and drawing out an electron current J_e is less than the value $(m/M)^{1/2} J_e$ required by Langmuir's theory. This was proved experimentally. In the experimental device the main discharge space between emitter and collector was supplied with ions through the meshes of a metal gauze, from an auxiliary glow discharge. Probe measurements indicate electron temperatures of the order of 0.15–0.25 v in an argon discharge, confirming that all ions are introduced through the gauze. By multiple collisions almost perfect temperature equilibrium is established between ions and neutrals. The small ion drift current was calculated from the measured electric and density gradients, with known values for ion mobility, and was found, in an example, about 100 times smaller than required by Langmuir's theory. The average

energy of the ions at the emitter was calculated as about 0.5 v. This leads to the conclusion that ions of such low energy are not absorbed by the emitter, as was hitherto assumed, but are reflected with a high probability. The ion space charge in the cathode sheath is in fact very nearly as required by Langmuir's theory, but it is produced by ions that are reflected about 50 times at the emitter before they are absorbed. In the experiment given as an example it was found that somewhat less than half of the ions are thrown back from the cathode sheath into the plasma and are pendulating between the plasma and the emitter, while the greater half is trapped, because they lose energy during their repeated passages through the cathode sheath, partly by collisions with gas atoms, partly by collisions with the emitter surface, so that they pendulate inside the cathode sheath, without reaching the plasma edge. This suggests that trapped ions may play a great part also in the hitherto mysterious phenomenon of the cold cathode spot in arcs. The reflection of very slow ions at the surface of solids is theoretically not quite unexpected, as these ions have insufficient energy to climb over the potential barrier, and may be returned in the first layer of atoms at the solid surface. (auth)

27981 INVESTIGATIONS ON NOBLE GAS FILLED THERMIONIC CONVERTERS. W. Bloss (Technische Hochschule, Stuttgart). Advanced Energy Conversion, 3: 315-21(Jan.-Mar. 1963).

A method for space charge compensation in noble gases and the performance of a special thermionic converter with operating temperatures not exceeding 1300°K are discussed. Low work function collector materials ($\phi_c \simeq 1$ v) are feasible in high vacuum or in noble gases only. Positive ions of noble gases for electron space charge compensation are produced in an auxiliary discharge. The influence of the low pressure plasma on the efficiency of conversion is investigated experimentally in different noble gases. Values of experimental devices are given: Mean efficiency of conversion 8 per cent, highest efficiency obtained 20 per cent; output power density of emitter surface 1 W/cm^2. (auth)

27982 A THERMIONIC GENERATOR WITH ION INJECTION. K. G. Cook, D. A. Fraser, and G. G. Isaacs (General Electric Co., Wembley, Eng.). Advanced Energy Conversion, 3: 323-31(Jan.-Mar. 1963).

Research on thermionic generators in which the space charge is neutralized by ions generated in an auxiliary discharge is reported. Electrons are accelerated in an electron gun and subsequently produce ions by collision in the space between emitter and collector. The dimensions of the gun are sufficiently small that, at pressures up to about 0.1 torr of xenon, the electron current remains substantially space charge controlled with accelerating voltages up to two or three times the ionization potential of the gas. The advantages of such a system are given, and an experimental generator of this type is described. It comprises a thoriated tungsten emitter, a barium on nickel collector giving a work function of about 2 v, and an electron gun. The device is filled with xenon at a pressure of about 0.1 torr. Typical results obtained with this system are as follows: Output power 2 W, ratio of output power to injection power 5:1, measured thermal efficiency 2 per cent. The main defect of the system is the failure to draw more than about 30 per cent of the available cathode emission. This may be associated with the use of a directly heated emitter, since the load current introduces potential gradients along the emitter surface. Present work includes the use of indirectly heated cathodes. (auth)

27983 THEORY AND PERFORMANCE OF AUXILIARY DISCHARGE THERMIONIC ENERGY CONVERTERS. R. C. Knechtli and Marvin Fox (Hughes Research Labs., Malibu, Calif.). Advanced Energy Conversion, 3: 333-49(Jan.-Mar. 1963).

A theory of auxiliary discharge thermionic energy converters is presented. This theory permits the prediction of a converter's I–V characteristics as functions of auxiliary discharge current, auxiliary discharge voltage and geometry. It also permits the prediction of the resistive voltage drop across the plasma as a function of load current. Measurements of auxiliary discharge converter I–V characteristics were performed with auxiliary discharge current and voltage as parameters. These measurements are presented and compared with theoretical predictions. The relatively low auxiliary discharge currents, low auxiliary discharge powers, and low plasma resistivities observed in these experiments are found to be consistent with the theory. (auth)

27984 SOURCES OF POSITIVE IONS FOR SPACE CHARGE NEUTRALIZATION AT LOW TEMPERATURES. R. A. Laubenstein (Marquardt Corp., Van Nuys, Calif.), C. Kaplan, S. Schneider, and J. Creedon. Advanced Energy Conversion, 3: 351-61(Jan.-Mar. 1963).

Two methods for providing positive ions for space charge neutralization in thermionic cells using fossil fuels burned in air were investigated. These were: the thermionic emission of positive ions from solid compounds or mixtures of compounds, and the application of repeated short pulses of electric power to the converter to ionize the cesium vapor in the interelectrode space. Ion emission from the eucryptite analog of alkali metals and from mixtures containing alkali metal compounds was studied. Ion emission current densities of several milliamperes per cm^2 were obtained, but the lifetime of the emitter was often less than anticipated. Space charge neutralization electrons were demonstrated in a preliminary experiment using a three element structure with the ion emitter located between the electron emitter and collector. Pulsed operation of a thermionic diode was studied using a modified commercial diode to which cesium vapor was introduced at controlled pressures. During the application of a 10 to 20 v pulse, a discharge occurs in the cesium; and ions are formed. After the pulse is terminated, the ions formed neutralize the space charge and allow a high electron current to flow. The experimental tube has a nickel matrix emitter and a cesium coated copper collector so that the relative work functions of the emitter and collector do not allow useful power output densities to be obtained. However, an external bias voltage was used to adjust the interelectrode potential difference to simulate a thermionic converter. The diode current after the pulse was terminated was typically about 300 m amp compared to a steady state current before the pulse of about 0.3 m amp. Preliminary results indicate a charge transfer between emitter and collector between pulses that is 30 times the charge transfer during the pulse. Further work to optimize this ratio and to provide the pulse feedback of a portion of the diode output power is in progress. (auth)

27985 NUCLEAR GENERATED PLASMAS IN NOBLE GAS THERMIONIC CONVERTERS. F. E. Jamerson, R. H. Abrams, Jr., C. B. Leffert, and R. Silver (General Motors Corp., Warren, Mich.). Advanced Energy Conversion, 3: 363-83(Jan.-Mar. 1963).

The generation of a plasma by fission fragment ionization in noble gas thermionic converters was investigated in a series of inpile experiments at the University of

Michigan reactor. The plasma generated in Ne:Ar (1000:1) at a pressure of 20 mm Hg was investigated in a plane parallel diode with electrically heated emitter and collector of barium impregnated tungsten. The fission fragment source was uranium foil mounted on a third electrode. As calculated from diode V–I characteristics, ion densities of order 10^{10} cm^{-3} were generated by fission fragments in the space surrounding the converter, and ion densities of order 10^{11} cm^{-3} were present in the interelectrode gap due to the formation of ion trapping sheaths at the electrode surfaces during normal converter operation. The effect on converter operation of cesium generated in the fission process was investigated in a tube with a diode structure and filling as above, but with a fission product source shielded from the interelectrode space. No cesium effects were observed during the $11\frac{1}{2}$ hr of tube operation. The ion density due to the reactor gamma flux was calculated from the V–I characteristic to be of the order 10^{8}–10^{9} cm^{-3}. Fission product poisoning of the collector was observed at temperatures less than 1000°K; the collector could be reactivated. To investigate the plasma generated by fission fragments in Xe at a pressure of 8 mm Hg, a plane parallel diode was constructed with a nuclear heated emitter of uranium carbide–rhenium and a barium impregnated tungsten collector. The emitter operating temperature was 1950°K in a neutron flux of 5×10^{12} cm^{-2} sec^{-1}. Discontinuities were observed in the forward current characteristic between 6–7 v. The effects between 6 and 7 v were attributed to the formation of xenon metastable atoms in the collector sheath that could then produce additional ionization. The discontinuity at 10 v was attributed to Xe breakdown. The ion density calculated from the V–I characteristic before the first discontinuity was of order 10^{9} cm^{-3}. (auth)

27986 SPACE CHARGE NEUTRALIZATION IN THERMIONIC DIODES CONTAINING FISSION PRODUCT KRYPTON. R. Forman and J. A. Ghormley (Union Carbide Corp., Parma, Ohio). Advanced Energy Conversion, 3: 385-6(Jan.-Mar. 1963).

Currents in high-pressure (1-300 mm) inert gas diodes at filament temperatures around 3000°K are known to exceed those predicted by space charge limitations, perhaps due to thermal ionization. The possibility of achieving the same effect at lower temperatures by using a radioactive source as the ionizing medium was examined since calculations also showed that enough positive ions might be produced for space charge neutralization. Characteristics of cylindrical diodes with vacuum, natural Kr, and fission-product Kr and using Ta anodes with oxide cathode and thoriated-W filaments were studied. The thoriated-W diode filled with fission-product Kr showed current-voltage characteristics not predicted by space charge limitations, and the diodes containing fission-product Kr displayed negative resistance in the current-voltage characteristics. (D.C.W.)

27987 THERMIONIC ENERGY CONVERTER WITH A LIQUID COLLECTOR. P. Brosens and G. N. Hatsopoulos (Thermo Electron Engineering Corp., Waltham, Mass.). Advanced Energy Conversion, 3: 387-96(Jan.-Mar. 1963).

The advantages and disadvantages of thermionic diodes using liquid collectors are reviewed. It is pointed out that one of the major parameters upon which the practical value of such devices depends is the depth of immersion that the emitter walls can have without resulting in instability of the film boiling process. The flow conditions in the film are derived from first principles. These are then combined with the Helmholtz stability analysis for the boundary between two fluids to find the maximum depth of immersion that the heat source walls can have in a stable film boiling regime. It is also pointed out that, generally, only a fraction of this maximum immersion depth can be used owing to the excessive film thickness that is otherwise achieved near the liquid surface and for which no useful diode output can be obtained. Expressions for the film thickness and vapor velocity in the film are given. The results of mercury and cesium film boiling experiments are discussed. The major conclusion reached is that intense cooling of the film interface with the liquid is required in order to achieve depths of immersion exceeding one inch in practical cesium devices. (auth)

27988 THERMIONIC ENERGY CONVERSION DIODE USING A FILM BOILING LIQUID METAL ELECTRON COLLECTOR. A. J. Ulrich (Argonne National Lab., Ill.). Advanced Energy Conversion, 3: 397-405(Jan.-Mar. 1963). (TID-14705; UAC-5121)

Recent experiments have shown that a diode can be produced consisting of a hot emitter and a liquid metal collector separated by the vapor film created in film boiling. In such a diode the metal vapor pressure can be brought in the range of a few millibars or less by, for example, controlling the pressure of an inert gas blanket that covers the film boiling liquid. If conditions in the film are appropriate for production of plasma a thermionic energy conversion plasma diode results. In initial experiments a drop of NaK (22% Na; 78% K) film boiled in a heated tantalum cup. The estimated heat flux required to support the vapor film was about $\frac{1}{6}$ of the black body radiated heat when the emitter temperature was 1930°K. In later experiments, demonstrating continuous operation, a heated emitter was partially inserted into a pool of potassium which could be cooled below the boiling point. The maximum subcooling that permitted film boiling was found to be strongly dependent on vapor pressure and depth of submersion and weakly dependent on emitter temperature. However, greater thermal instability occurred at lower emitter temperatures. The current voltage shapes showed that the vapor film thickness was great enough for transport losses to be apparent under all of the conditions investigated thus far. (auth)

27989 GRAPHICAL METHOD FOR OPTIMIZATION OF CESIUM-SURFACE IONIZER MATERIALS. G. Kuskevics (Electro-Optical Systems, Inc., Pasadena, Calif.). AIAA (Am. Inst. Aeron. Astronaut.) J., 1: 1455-8(June 1963).

A graphical method is proposed for the optimization of cesium ionizer material, structure, and operating point. Proper selection of the ionizer material, its structure and work function, and the design point optimizes the propellant-utilization efficiency, power efficiency, and, to some extent, life of the cesium-ion engine. The method is illustrated by optimization of the design point for a solid tungsten ionizer using exponential and linearized plots and by selection of optimum material based on preliminary experimental critical temperature curves and theoretical neutral fraction curves. (auth)

27990 THE PRINCIPLE OF EQUIVALENCE. F. Rohrlich (State Univ., Iowa City, Iowa and Argonne National Lab., Ill.). Ann. Phys. (N. Y.), 22: 169-91(May 1963). (SUI-62-18)(UAC-6925)

Various statements identified with the principle of equivalence are not acceptable because they are either not generally valid or are simply the definition of an inertial coordinate system. The accepted statement refers, roughly speaking, to the equivalence of inertial mass with passive

and active gravitational mass. The clarification of this problem is greatly eased by a detailed study of the static homogeneous gravitational field that precedes the discussion of the equivalence principle. The role of electromagnetic phenomena, and, in particular, the presence of a charge in such a field is analyzed in detail. (auth)

27991 A PERTURBATION SOLUTION OF THE EQUATION OF MOTION FOR THE DENSITY MATRIX. Hernan C. Praddaude (Massachusetts Inst. of Tech., Cambridge). Ann. Phys. (N. Y.), 22: 210-22(May 1963).

A solution of the Laplace transform of the equation of motion for the density matrix is obtained in terms of a resolventlike operator. A suitable expansion of the resolvent in terms of irreducible matrix elements is obtained and, as an application of the formalism, the emission of radiation from a two-level system is treated in the lowest order of present perturbation theory. (auth)

27992 STARK BROADENING OF BALMER LINES AT LOW ELECTRON DENSITIES. E. Ferguson (Univ. of Texas, Austin) and H. Schlueter. Ann. Phys. (N. Y.), 22: 351-72(June 1963).

Profiles of the Balmer lines are measured for a low electron density by means of a radio frequency discharge in a static magnetic field. The far wings of the lines H_5 and H_8 and complete profiles of higher lines up to the principal quantum number 16 are compared with theory. The observations cover cases where both ions and electrons may be considered as quasi-static perturbers as well as cases where a collisional, quantum-mechanical treatment for the electrons is appropriate. In the region of validity of a quasi-static description of the perturbations by the electrons and even in the transition region to the collisional behavior of the electrons good agreement is found between the experimental results and those of the quasi-static calculations. Correlation and shielding effects are taken into account. Satisfactory agreement is also found with the results of the quantum-mechanical calculations, provided recent modifications are used that incorporate a smooth transition between collisional and quasi-static perturbations by the electrons. (auth)

27993 HYSTERESIS IN HARD SUPERCONDUCTORS. J. Silcox and R. W. Rollins (Cornell Univ., Ithaca, N. Y.). Appl. Phys. Letters, 2: 231-3(June 15, 1963).

To incorporate the effects of pinning due to defects and predict size-dependence and hysteresis in the magnetization curves of hard superconductors, the Abrikosov-Goodman theory is developed. The interaction forces between fluxoid filaments are determined semiempirically. The method developed is illustrated by application to a simple case. (C.E.S.)

27994 LOW-PRESSURE GLOW DISCHARGE. G. W. McClure (Sandia Lab., Albuquerque, N. Mex.). Appl. Phys. Letters, 2: 233-4(June 15, 1963). (TID-18642; SCDC-3185)

A cold-cathode gaseous discharge device is presented in which highly efficient electrostatic trapping of electrons permits a gaseous discharge to occur at pressures down to 10^{-5} Torr with applied d-c voltages less than 2 kv. The device provides a simple means of ionizing a gas at a low pressure and has potential applications as an accelerator ion source, an ionic pump, and a pressure gage. Discharges of many amperes can be achieved by pulsing the device at potentials slightly above the starting potential. (C.E.S.)

27995 HYDROMAGNETIC WAVES IN INHOMOGENEOUS MAGNETIC FIELDS OF CONSTANT DIRECTION. Ryszard Gajewski (Inst. for Nuclear Research, Warsaw) and Friedwart Winterberg. Astrophys. J., 137: 1203-9 (May 15, 1963).

Propagation of hydromagnetic waves in a non-viscous, perfectly conducting, incompressible fluid is studied in a linear approximation, under the assumption of an unperturbed magnetic field $H_0 = H_0(x)n$, where n is a constant unit vector. It is shown that there are two possible types of waves: Alfvén waves, propagating along the lines of force with a velocity $u = H_0/(4\pi\rho)^2$; waves analogous to the gravity waves that can, in general, propagate across the lines of force. In particular, it is shown that if $u^2 = \text{const.} + ax$, those waves travel in a direction perpendicular to n and to the x-axis with a group velocity $\frac{1}{4}\alpha/\omega$ and a phase velocity $\frac{1}{2}\alpha/\omega$. The results may apply to the magnetic field in an area between two sunspots forming a pair. (auth)

27996 SEMIEMPIRICAL ELECTRON AFFINITIES. Michele Kaufman (Harvard Coll. Observatory, Cambridge, Mass.). Astrophys. J., 137: 1296-1301(May 15, 1963).

Electron affinities of light atoms were computed from an expansion in inverse powers of an effective nuclear charge $Z-\sigma$, truncated after the term $(Z-\sigma)^{-1}$. Coefficients were given their theoretical values or computed by extrapolation along isoelectronic sequences. For hydrogen and helium, theoretical relativistic terms were included in the expansion. For the atoms hydrogen through magnesium, calculations were made with both two and three empirical parameters. Comparison with experimental values confirms the validity of using the Z-dependent expansion to calculate ionization potentials of negative ions. Comparison with the results of semiempirical calculations by others shows that the best agreement with experiment is obtained when the extrapolation involves no more than three experimental ionization potentials, the term $(Z-\sigma)^{-1}$ is included, available theoretical values of parameters are used, and relativistic terms are allowed for. (auth)

27997 A GRAPHICAL METHOD FOR THE INVESTIGATION OF MAGNETOHYDRODYNAMIC GENERATORS. B. Buergel. Brown Boveri Rev., 49: 493-500(Nov.-Dec. 1962).

A graphical process is outlined which presents a clear survey of certain properties exhibited by various types of magnetohydrodynamic (MHD) generators. For this purpose a diagram is devised which contains the curves for constant electrical and brake outputs and for constant efficiency. Every generator corresponds to a well-defined section of the diagram. As an example, the output characteristics of various types of generators are investigated. (auth)

27998 DEVELOPMENTS IN THE FIELD OF THERMOELECTRICITY. G. Gramberg and H. G. Plust. Brown Boveri Rev., 49: 501-14(Nov.-Dec. 1962).

In recent years thermoelectricity has become increasingly interesting in the fields of refrigeration and for the direct conversion of heat into electrical energy. General considerations show that the efficiency of this method is governed by the Carnot cycle and by a material factor known as the "figure of merit." The efficient utilization of thermoelectricity requires materials with a high figure of merit: the discovery of such materials is the task of the physicist. Since the thermoelectric production of energy and electrothermal refrigeration are based on the same physical phenomena, both can be devolved from the same first principles. These basic principles are described along with some salient points concerning development work into electrothermal refrigeration. (auth)

27999 THE BEHAVIOR OF FISSION PRODUCTS CAPTURED IN GRAPHITE POWDER BY NUCLEAR RE-

COIL. VI. THE CHEMICAL STATE OF IODINE-131 DIFFUSED OUT FROM GRAPHITE, URANIUM DIOXIDE AND THORIUM DIOXIDE. Seishi Yajima, Koreyuki Shiba, and Muneo Handa (Japan Atomic Energy Research Inst., Tokyo). Bull. Chem. Soc. Japan, 36: 253-8(Mar. 1963). (In English)

The chemical state of the fission fragment I^{131} diffusing out of UO_2 or ThO_2 into graphite was studied by means of thermochromatography. The results show that the chemical state of the fission fragment I^{131} is the iodide, and it is suggested that I^{131} combines with U or Th to form the iodide. (D.L.C.)

28000 THE BEHAVIOR OF FISSION PRODUCTS CAPTURED IN GRAPHITE POWDER BY NUCLEAR RECOIL. VII. THE ACTIVATION ENERGY OF THE DIFFUSION OF IODINE-131 IN GRAPHITE. Seishi Yajima, Koreyuki Shiba, and Muneo Handa (Japan Atomic Energy Research Inst., Tokyo). Bull. Chem. Soc. Japan, 36: 258-63(Mar. 1963). (In English)

An investigation was undertaken to determine the activation energy of iodine diffusion in graphite and the mechanism of diffusion and formation of the iodide. The heating curve of deposited iodide was found to have a peak at 530°C, while a diffusion peak occurred at 750°C, with an activation energy of 47 kcal/mole. The results are compared with diffusion of xenon and annealing of graphite irradiated with fast neutrons. (D.L.C.)

28001 RANGE OF Xe^{133} AND Ar^{41} IONS OF KILOELECTRON VOLT ENERGIES IN ALUMINUM. J. A. Davies, F. Brown, and M. McCargo (Atomic Energy of Canada Ltd., Chalk River, Ont.). Can. J. Phys., 41: 829-43(June 1963). (AECL-1725)

Detailed studies of the range and range distribution of Xe^{133} and Ar^{41} ions in aluminum were made over a wide energy region: 0.5–240 kev for Xe; 0.7 kev to 2.25 Mev for Ar. The results agree well with the previous alkali metal ion measurements. The experimental distribution curves consist of an asymmetric peak followed by a point of inflection and an exponential tail. The change in peak shape with increasing energy agrees at least qualitatively with the expected transition from nuclear to electronic stopping. The theoretical range-energy curve of Lindhard and Scharff fits the experimental data quite well over most of the energy region studied, but significant deviations occur at the lower energies. (auth)

28002 THE EFFECT OF ENERGY AND INTEGRATED FLUX ON THE RETENTION AND RANGE OF INERT GAS IONS INJECTED AT kev ENERGIES IN METALS. F. Brown and J. A. Davies (Atomic Energy of Canada Ltd., Chalk River, Ont.). Can. J. Phys., 41: 844-57(June 1963). (AECL-1726)

Two experimental factors limiting the use of ion-bombardment techniques in atomic range studies were investigated: the fractional retention of the incident beam, and the target saturation phenomenon. The fractional retention, or sticking factor, was measured for Xe^{133} in Be, Al, Ni, Zr, Ag, Ta, W, and Au, and for Ar^{41} and Kr^{85} in Al and W, as a function of bombardment energy from 1 to 150 kev. The results indicate that, below about 5 kev, range measurements are of doubtful significance; in some cases, this energy limit for a reliable range measurement is considerably higher than 5 kev. A qualitative interpretation of the observed sticking factors is given. The saturation phenomenon in aluminum was studied by injecting radioactive Xe in trace amount, either before, after, or during a bombardment with one of the stable Xe isotopes, and measuring the final distribution of the embedded radiotracer. The results provide information on the mechanism of target saturation. Bombardment with 2-3 μg of xenon/cm^2 is found to reduce markedly the observed penetration depth of a 30-kev beam, thereby indicating the necessity of trace bombardments for accurate range measurements in this energy region. (auth)

28003 IMPORTANCE OF SYMMETRIES IN THE CALCULATION OF THE COULOMB ENERGY OF He^3. Joseph Proriol. Compt. Rend., 256: 3830-2(Apr. 29, 1963). (In French)

The introduction of space variable functions having intermediate symmetry in the wave function of a three-nucleon system permits an improvement in the calculation of the Coulomb energy of He^3 of 6% in the point nucleon hypothesis and of 5% for an electric charge distribution of exponential form. (tr-auth)

28004 THE CALCULATION OF THE TRANSFER OF RADIATION INTO X FLUORESCENCE. THE MATRIX EFFECT. THE FORMAL SOLUTION OF THE TRANSFER EQUATION AND THE CALCULATION OF MASSIVE EMISSION COEFFICIENTS. Michel Renaud (Laboratoire de Chimie Physique, Orsay, France). Compt. Rend., 256: 3837-40(Apr. 29, 1963). (In French)

The differential equation for describing radiation transfer into x fluorescence in a sample of N elements under the effect of a convenient exciting radiation, is solved. The correlations existing between massive emission coefficients and the solutions of this equation are established. (tr-auth)

28005 CONDITIONS OF SHOCK FOR A MAGNETODYNAMIC FLOW OF WEAKLY DISSIPATIVE FLUIDS. Roger Peyret. Compt. Rend., 156: 4156-7(May 13, 1963). (In French)

The results obtained by Germain and Guiraud (ONERA, No. 105) for the shock conditions in a non-stationary flow of gas dynamics with dissipative mechanisms were extended to the non-stationary magnetodynamic flow of finite electric conductivity. (tr-auth)

28006 THE PRODUCTION OF STRONG MAGNETIC FIELDS. Mario Morpurgo (CERN, Geneva). Ind. At., 7: No. 3-4, 73-9(1963). (In French)

The different methods used for the production of strong magnetic fields are considered, and the technology relative to the construction of coreless coils is examined. A brief review is given of the possibilities offered by the construction of magnets by cryogenics and by superconductivity. (tr-auth)

28007 DISCRETE FREQUENCIES IN A LATTICE PERTURBED BY ISOTOPE DEFECTS. J. Mahanty and Ram Kishore Sharma (Panjab Univ., Chandigarh, India). Indian J. Phys., 37: 127-38(Mar. 1963).

An investigation is made of the process of generation of discrete vibration frequencies outside the allowed frequency bands of a lattice when it is perturbed by the change of the mass of an atom. A criterion for monatomic lattices is described that enables one to predict whether in the perturbed state of the lattice, the discrete frequency generated from any branch is independent of the other branches. Finally, the discrete frequencies in the case of several linear lattice models are evaluated. (auth)

28008 SOME OBSERVATIONS ON THE SCATTERING OF β-PARTICLES BY THICK ABSORBERS. G. C. Snyman and C. G. Clayton (Wantage Research Lab., Berks, Eng.). Intern. J. Appl. Radiation Isotopes, 14: 183-8(June 1963). (In English)

Using a range of elements of differing atomic number,

the variation in intensity of backscattered electrons with energy of the incident β particles was measured with a β spectrometer. The method also allows observations to be made about the variation in energy of backscattered electrons with atomic number. The presence of high-energy electrons in the emergent spectrum is in conflict with experiments based on absorption methods of energy differentiation. The value of energy selection in practical applications of β-backscattering is noted. (auth)

28009 IONIZATION DISTRIBUTION IN CYLINDERS IRRADIATED WITH MONOENERGETIC ELECTRONS. E. H. Cornish (Standard Telecommunication Labs. Ltd., Harlow Essex, Eng.). Intern. J. Appl. Radiation Isotopes, 14: 189-96(June 1963). (In English)

The distribution of ionization within a solid cylinder, irradiated normally to its axis by a parallel beam of initially monoenergetic electrons, was studied with the aid of a physical model. This comprised an assemblage of laminae, each shaped to the profile of the ionization distribution curve which applies to a slab of material irradiated on its face. The laminae were stacked to simulate cylinders of different radii with respect to electron range, and ionization levels at any point within a real cylinder could be obtained from the model. Curves are presented showing peripheral ionization levels as a function of cylinder diameter, and average dose factor values were computed from the results. Other experiments using dyed "phantoms" of wire cores and cables showed the extent to which the conductor will throw a shadow in a parallel electron beam impinging normally to the wire axis. In most cases, where the conductor diameter is less than 50 per cent of that of the whole core, electron scattering is adequate to process the material in the shadow. (auth)

28010 THE MOMENTUM INTEGRAL APPROXIMATION FOR COMPRESSIBLE MAGNETOGASDYNAMIC BOUNDARY-LAYER FLOW. J. J. Kauzlarich (Univ. of Washington, Seattle) and A. B. Cambel. J. Appl. Mech., 30: 269-74(June 1963).

The drag of an adiabatic flat plate in an ionized gas for a constant magnetic field applied to the boundary layer on the plate is found by a momentum integral approximation of von Karman. Laminar, two-dimensional flow, zero pressure gradient, small magnetic Reynolds number, and negligible electrical conductivity outside the boundary layer are assumed. The solution is valid in particular to a continuous, perfect-gas plasma, of unitary Prandtl number, and for conditions when the interaction parameter is very small. The solution shows the following effects: the adiabatic wall temperature is independent of the magnetic field; there is an increase in the boundary-layer thickness as the magnetic-field strength is increased; and the viscous drag coefficient decreases whereas the coefficient of total drag increases. (auth)

28011 LUMINESCENCE OF RARE GASES EXPOSED TO IONIZING RADIATION IN AN ELECTRIC FIELD. Aleksander Szymanski and Jan A. Herman (Laval Univ., Quebec). J. Chim. Phys., 60: 379-86(Mar. 1963). (In French)

The luminescence between 3200 and 5000 Å of rare gases exposed to x or α radiation at pressures between 40 and 500 mm Hg was studied in an electrostatic field. The intensity of the light emitted is compared to the Druyvesteyn theory on the energy distribution of electrons undergoing nonelastic impacts in the gas. For low values of E/P, the luminous emission follows the Druyvesteyn distribution. However, in the case of Kr and Xe, the emission varies nonlinearly with the pressure, suggesting a de-excitation mechanism of the atomic and molecular species. For values of E/P higher than 3, the excitation of Ar, Kr, and Xe is more complex: it is probable that there exists in this case a secondary excitation of the species already excited or ionized. (tr-auth)

28012 ON THE RAYLEIGH-TAYLOR PROBLEM IN MAGNETOHYDRODYNAMICS WITH FINITE RESISTIVITY. J. D. Jukes (Atomic Energy Research Establishment, Harwell, Berks, Eng.). J. Fluid Mech., 16: 177-86(June 1963).

In order to elucidate the importance of the infinite conductivity assumption in MHD, a simple problem was studied. This is a Rayleigh-Taylor problem of two superposed fluids under gravity partially stabilized by a uniform, horizontal magnetic field. It was found that the inclusion of a small, but finite resistivity introduces new and unexpected solutions. For instance, moderately long, "stabilized" waves were found to grow aperiodically and unexpectedly rapidly at a rate $\propto$ (resistivity)$^{-\frac{1}{3}}$. Other modes were found to be periodic and damped at a rate $\propto$ (resistivity)$^{-\frac{1}{3}}$. (auth)

28013 INSTABILITY OF A SURFACE OF DISCONTINUITY OF VELOCITY IN A PARALLEL UNIFORM MAGNETIC FIELD. D. D. Mallick (Calcutta Univ.). J. Fluid Mech., 16: 187-96(June 1963).

The problem was investigated when the magnetic field was uniform and parallel to the velocity on the two sides of a surface of discontinuity of velocity in an electrically conducting inviscid fluid. The secular equation depends on two parameters β and N, where β is the ratio of magnetic Reynolds number to dimensionless wave number and N is the ratio of the magnetic to the kinetic energy of the fluid. It was found that the flow is unstable for all values of β and N. (auth)

28014 MAGNETOGASDYNAMIC DEFLAGRATION AND DETONATION WAVES WITH IONIZATION. J. B. Helliwell (Royal Coll. of Science and Tech., Glasgow). J. Fluid Mech., 16: 243-61(June 1963).

The propagation of a one-dimensional combustion wave into a non-ionized gas at rest in the presence of an electromagnetic field is considered when ionization of the gas occurs across either the combustion wave or a preceding shock wave. The electric and magnetic fields in the undisturbed gas ahead of the waves are mutually perpendicular and orthogonal to the direction of wave propagation. It is shown that steady detonation occurs at a point which is analogous to the Chapman-Jouguet point of ordinary gasdynamic combustion theory. Numerical calculations were made of the state of the gas between and behind the waves in two particular models, in both of which the upstream electric field is zero. The models were equivalent to magnetogasdynamic phenomena in a perfectly conducting gas. The case of steady detonation was studied. Steady deflagration in a tube, closed at one end, is discussed. (auth)

28015 MAGNETOHYDRODYNAMIC FLOW IN A RECTANGULAR TUBE AT HIGH HARTMANN NUMBER. W. E. Williams (Liverpool Univ.). J. Fluid. Mech., 16: 262-8(June 1963).

Asymptotic forms, valid for high Hartmann number M, were obtained for the mean velocity for laminar magnetohydrodynamic flow in a rectangular tube. For a tube with non-conducting walls it was found that, neglecting exponentially damped terms, the mean velocity can be expressed in closed form in terms of tabulated functions.

The first three terms of the expansion of the mean velocity in inverse powers of M are in extremely close agreement with a corresponding expansion obtained by Shercliff using a boundary-layer method. For perfectly conducting walls the first five terms of an expansion in inverse powers of M were obtained. (auth)

28016 IONOSPHERIC ABSORPTION OF COSMIC RADIO NOISE AND CHORUS AT THE AURORAL ZONE. Tadanori Ondoh (Kyoto Univ.). J. Geomagnet. Geoelec., 14: 133-43(1963). (In English)

A close relation between ionospheric absorption of cosmic radio noise and chorus intensity at the auroral zone is found for diurnal variations on geomagnetically quiet days, those on geomagnetically disturbed days, and storm-time variations for periods of no polar-cap absorption from September, 1959 to December, 1960. The relation of the cosmic noise absorption to the chorus and to geomagnetic pulsation at the auroral zone and possible mechanisms of VLF emissions in the outer exosphere are discussed. (auth)

28017 MOTION OF CHARGED PARTICLES IN SLOWLY VARYING FIELDS TO THE FIRST ORDER OF APPROXIMATION. Ruth Gall (National Univ. of Mexico, Mexico City). J. Geophys. Res., 68: 3565-76(June 15, 1963).

Following Bogolyubov's and Zubarev's perturbation method, the motion of a charged particle is analyzed to the first order of approximation. The general case of motion in a time-dependent nonhomogeneous magnetic field in the presence of an electric field and currents, as well as simpler cases, is considered. Correction terms of the average kinetic energy, the acceleration, and the position of mirror points, as well as a formula for the first adiabatic invariant to $1/\Omega$ order, were obtained. The guiding center's mirror points differ, in all cases, from the points of magnetic reflection of the particle, that contain an oscillatory term and depend on the average phase angle. Only for the case of a static nonhomogeneous field, in the absence of an electric field and currents, the magnetic moment is conserved and all the first-order correction terms vanish. (auth)

28018 DERIVATION OF ELECTRON-DENSITY PROFILES IN THE LOWER IONOSPHERE USING RADIO ABSORPTION MEASUREMENTS AT MULTIPLE FREQUENCIES. R. Parthasarathy (Geophysical Inst., College, Alaska), G. M. Lerfald, and C. G. Little. J. Geophys. Res., 68: 3581-8(June 15, 1963).

A new method was developed permitting the derivation, during disturbed ionospheric conditions, of the electron-density profiles in the lowermost ionosphere. On the basis of simultaneous measurement of ionospheric absorption on several frequencies, and an assumed model of the variation of electron collision frequency with height, the Sen-Wyller formulation of the magnetoionic theory is used to compute the profile best capable of producing the observed absorption values. The method is described, and some of its limitations are discussed. Its use is illustrated by means of representative electron-density profiles derived for the polar-cap absorption events of July 1961. These profiles show that the base of the layer varied in height from 30 to 50 km, and that the region of maximum absorption, for a frequency of 30 Mc, occurred systematically at about 60 km. (auth)

28019 IONOSPHERE CURRENT PATTERNS IN HIGH LATITUDES. Donald H. Fairfield (Pennsylvania State Univ., University Park). J. Geophys. Res., 68: 3589-3602(June 15, 1963).

Magnetograms from 25 high-northern-latitude geomagnetic observatories were used to study the current systems producing magnetic disturbances. Equivalent overhead current vectors representing directions and relative intensities of currents over the various stations were computed from the observed perturbations in the horizontal magnetic field components and plotted on polar maps, from which average current systems for specific hourly periods were studied. Successive hours on 28 quiet and moderately disturbed days of the IGY were investigated. The basic patterns of current flow revealed by these maps are the S_q and DS systems. Vectors corresponding to S_q currents are often below the auroral zone; higher-latitude stations afford evidence for currents flowing in the DS pattern, even on the most quiet days. Current vectors at the three highest-latitude stations are generally parallel and pointing west of the sun direction in accord with the usual DS pattern. Changes in this polar-cap current direction as indicated by these stations suggest a change in orientation of the DS pattern with respect to the sun direction that is occasionally quite large and rapid. (auth)

28020 WHISTLER MEASUREMENTS OF ELECTRON DENSITY AND MAGNETIC FIELD STRENGTH IN THE REMOTE MAGNETOSPHERE. D. L. Carpenter (Stanford Univ., Calif.). J. Geophys. Res., 68: 3727-30(June 15, 1963).

Spectrographic records of high-latitude whistlers were used to measure the magnetospheric electron-density variations with time and plot them as a function of geomagnetic coordinates. Geomagnetism in the remote magnetosphere was investigated using data on the observed minimum gyrofrequency along the field-line path of the whistler. (C.E.S.)

28021 STRUCTURE OF THE TWO-POINT FUNCTION. O. Steinmann (Inst. for Advanced Study, Princeton, N. J.). J. Math. Phys. (N. Y.), 4: 583-8(May 1963).

The two-point functions of relativistic quantum field theory are discussed in the framework of distribution theory. A derivation in this framework of the Källén-Lehmann representation is given. The singularities in x-space are studied for the example of the D_F function. It is in general not possible to extract a singularity with support on the light cone. It is shown, however, that D_F is, at best, a measure in any neighborhood of the light cone. Thus, Lehmann's statement that D_F is at least as singular as the corresponding free-field function is confirmed. (auth)

28022 QUANTUM FIELD-THEORY MODEL WHOSE TRUNCATED VACUUM EXPECTATION VALUES VANISHED BEYOND SOME ORDER. O. W. Greenberg (Univ. of Maryland, College Park), and A. L. Licht. J. Math. Phys. (N. Y.), 4: 613-14(May 1963).

A local quantum field that has a complete asymptotic field of mass m, and whose truncated vacuum expectation values vanish beyond some order, is proved to lead to no scattering or reactions. (auth)

28023 NOTE ON UNIQUENESS OF CANONICAL COMMUTATION RELATIONS. R. Arnowitt and S. Deser (Brandeis Univ., Waltham, Mass.). J. Math. Phys. (N. Y.), 4: 615-17(May 1963).

It was pointed out by Wigner that the consistency requirement between the Lagrange and Heisenberg equations of motion does not uniquely determine the canonical commutation relations, at least for one-dimensional systems. It is shown here that this ambiguity does not arise in local field theory whose basic equal-time commutators commute with the translation operator. (auth)

28024 NEW METHOD IN THE THEORY OF IMPERFECT GASES AND LIQUIDS. Elliott Lieb (International Business Machines Corporation, Yorktown Heights, N. Y.). J. Math. Phys. (N. Y.): 4: 671-8(May 1963).

A new expansion method for the thermodynamic properties and correlation functions of imperfect gases is derived. When the interparticle potential is repulsive, an alternating series of upper and lower bounds is obtained for the activity, free energy, pressure, entropy, internal energy, and for the correlation functions. These bounds are valid even if there is a transition. If the potential has an attractive part, upper bounds can be obtained for the activity, free energy, internal energy, and the correlation functions. (auth)

28025 NONLINEAR COUPLED OSCILLATORS. II. COMPARISON OF THEORY WITH COMPUTER SOLUTIONS. E. Atlee Jackson (Univ. of Illinois, Urbana). J. Math. Phys. (N. Y.), 4: 686-700(May 1963).

A study is made of a particular system of coupled oscillators to determine how the amount of energy exchange and the recurrence time depend on the parameters of the system, and the accuracy with which these are predicted by the perturbation theory previously developed. The system consists of N + 1 particles, connected by springs that have a quadratic force term, the strength of which, λ_i, can vary between different particles ("defects"). The equations of motion for the perfect chain ($\lambda_i = \lambda$) were solved on a computer for the cases N = 4, $\lambda = 1/4, 1/2, 3/4$; and N = 9, $\lambda = 1/2$; and supplemented by the previous calculations of Fermi, Pasta, and Ulam, in which N = 32, $\lambda = 1/4$, 1. The "energy" in the linear modes, $E_k(t) = \frac{1}{2}(\dot{a}_k^2 + \omega_k^2 a_k^2)$, are determined from these computations and compared with the perturbation theory in the first paper of this series. As was found by Fermi, Pasta, and Ulam, when only E_1 is initially excited, then only the first few modes acquire an appreciable amount of energy, after which nearly all the energy returns to the first mode in a time $\tau\lambda$. The second-order perturbation theory is found to give an accurate estimate (within 15%) of both $\tau\lambda$ and the amount of energy exchange for all the above cases, except N = 32, $\lambda = 1$, which requires higher-order analysis. It is shown that the nonergodic behavior of this system does not result simply from the incommensurability of the uncoupled frequencies $\{\omega_k\}$, but also from the particular form of mode interaction and the initial conditions used in all calculations, both of which affect the coupled frequency spectrum $\{\Omega_k\}$. To alter the mode interaction a preliminary study is made of "imperfect" chains (variable λ_i), which directly couple low and high modes. It is found that either a large, or else systematic, variation of λ_i is necessary to appreciably alter the nonergodic behavior of this system. A theoretical examination of the dependence of the coupled frequencies $\{\Omega_k\}$ on the initial conditions shows that the ergodic behavior will, in general, be strongly dependent upon the initial conditions. (auth)

28026 INTENSITY MODULATION OF BALMER LIGHT FROM A HIGH-FREQUENCY DISCHARGE. S. M. Hamberger (United Kingdom Atomic Energy Authority, Abingdon, Berks, Eng.). J. Nucl. Energy, Pt. C, 5: 73-81(Mar.-Apr. 1963).

A very simple light source is described that is capable of emitting spectral lines whose intensities can be modulated up to 100 per cent at frequencies of the order of 10^7 c. Experimental results are given that show the waveform of the light intensity emitted from a hydrogen source for a range of frequency and gas pressure. These results are explained by the fluctuations of the mean energy of electrons, the theory agreeing well with experiment for specific examples. (auth)

28027 A SIMPLE THEORY OF WALL EVAPORATION IN A PULSED GAS DISCHARGE. D. E. T. F. Ashby (United Kingdom Atomic Energy Authority, Culham, Berks, Eng.). J. Nucl. Energy, Pt. C, 5: 83-7(Mar.-Apr. 1963). (In English)

A simple theory is presented that predicts that the walls surrounding an intense pulsed gas discharge should evaporate when a certain critical current is exceeded. Examples drawn from existing pinch discharges are in rough agreement with this theory. (auth)

28028 DETERMINATION OF THE REFRACTIVE INDICES OF GASES IN THE VACUUM ULTRAVIOLET. I. THE ČERENKOV RADIATION METHOD. D. W. O. Heddle, R. E. Jennings, and A. S. L. Parsons (University Coll., London). J. Opt. Soc. Am., 53: 840-6(July 1963).

A method of measuring refractive indices of gases in the vacuum ultraviolet using the electron beam from a 4.5-Mev microtron to produce Čerenkov radiation in the gases is described. In this method the threshold pressures for Čerenkov radiation in the ultraviolet and visible regions are compared for electrons of the same velocity. The ultraviolet detectors used in the present experiment are photomultipliers with gold photocathodes and windows of: fused silica, and Spectrosil to give results at about 1900 Å and a nitric oxide ionization chamber with a lithium fluoride window for results at about 1200 Å. Preliminary results are quoted for the refractive indices of argon and nitrogen at 1200 and 1900 Å. (auth)

28029 DETERMINATION OF THE REFRACTIVE INDICES OF GASES IN THE VACUUM ULTRAVIOLET. II. THE RAYLEIGH SCATTERING METHOD. P. Gill and D. W. O. Heddle (University Coll., London). J. Opt. Soc. Am., 53: 847-51(July 1963).

A method of measuring refractive indices of gases by observations of Rayleigh scattered light is described. The method depends on the fact that the intensity of such scattered light is proportional to the square of the refractivity of the gas. Results are presented for several gases at a wavelength of 1216 Å. The values are placed on an absolute basis by use of the value of the refractive index of nitrogen found at 1220 Å by the Čerenkov method. Some extensions of the method are suggested. (auth)

28030 A FUNDAMENTAL EXTENSION OF EINSTEIN'S DIFFUSION-MOBILITY RELATIONSHIP. M. A. Melehy (Univ. of Connecticut, Storrs). Nature, 198: 980-1(June 8, 1963).

Fundamental consequences of the compatibility between drift and diffusion processes suggested by Einstein's diffusion-mobility relation are considered. The concept of a particle diffusion force is presented and an expression for this quantity is calculated. The collective contribution of the particle diffusion force could, perhaps, explain osmotic pressure effects. (C.E.S.)

28031 AN APPLICATION OF A NEW METHOD FOR THE SOLUTION OF GROUP DIFFUSION EQUATIONS TO A CYLINDRICAL FLUX TRAP ASSEMBLY WITH SPONTANEOUS FISSION SOURCE. Timo Toivanen (Inst. of Technical Physics, Otaniemi, Finland). Nucl. Sci. Eng., 16: 176-85(June 1963).

In the case of an infinite reflector, the group diffusion equations are converted to a system of integral equations by a Green's function technique. This system is then Fourier transformed. The transformed Fredholm-type equations have a degenerate kernel, and the solution may

be reduced to a system of linear algebraic equations with infinitely many unknowns. The theory is developed for the case of a three-group three-region cylindrical flux trap assembly. (auth)

28032 RADIATION NUCLEATION OF BUBBLES IN WATER. Amos Norman (Univ. of California, Los Angeles) and P. Spiegler. Nucl. Sci. Eng., 16: 213-17(June 1963).

A charged particle passing through water creates a thermal spike, a region of high temperature along the track. The thermal spike expands explosively, thus producing a pressure wave, and then breaks up because of surface tension into discrete regions of water vapor and hydrogen gas. These vapor-gas microbubbles can act as nucleation centers in superheated or gas supersaturated solutions. Calculations based on this thermal spike model are presented of the total energy and minimum linear energy transfer (LET) required to form nucleation centers of a given size, and the calculations are compared to published data on the radiation nucleation of superheated and supersaturated aqueous solutions. Calculations are also presented of the pressure created by the rapid expansion of the thermal spike, and of the lifetime of the vapor-gas microbubbles under conditions in which they collapse. The calculations cover an LET range of 0.1 to 10 Mev/μ or, approximately, from the maximum LET of recoil protons in water to the maximum LET of fission fragments in water. The calculations are carried out for a liquid pressure of one atmosphere and two temperature conditions: the minimum temperature at which vapor nuclei of given size will grow and 0°C. The effect of high pressures and temperatures on the radiation nucleation of vapor bubbles is discussed briefly in terms of the foam limit. (auth)

28033 INTENSITY OF HYDROGEN AND DEUTERIUM LAMPS IN THE ULTRAVIOLET REGION OF THE SPECTRUM. M. N. Smolkin and N. B. Berdnikov. Opt. Spectry. (USSR) (English Transl.), 14: 220-1(Mar. 1963).

A method for measuring the brightness of hydrogen and deuterium lamps is described, and values of the spectral intensity of the sources are given for the 200 to 400 mμ region. Measurements were performed by comparing the brightness of each of the tested lamps with that of a carbon arc in the 200 to 340 mμ spectral region and that of a tungsten ribbon incandescent lamp in the 330 to 400 mμ region. The brightness of the deuterium lamps was found to be 30 to 50 and 50 to 70% higher than the brightness of the hydrogen lamps. It was also found that the brightness of uviol (ultraviolet transparent) window lamps was greater than that of sapphire-window lamps. (P.C.H.)

28034 ZEEMAN EFFECT IN AN ALTERNATING FIELD. V. E. Mitsuk. Opt. Spectry. (USSR) (English Transl.), 14: 223-4(Mar. 1963).

Quantum mechanical treatment is given to the action on a radiating atom of an alternating magnetic field described by $\vec{H} = \vec{H}_0 \cos \omega t$. It is assumed that the field is uniform, and that the frequency of the external magnetic field is greater than the line-width as determined by conditions in the source, but less than the maximum split of the line in the static field $\mathcal{H}_0$. Spin-orbit interaction is ignored, and the case of the normal Zeeman effect is considered. (P.C.H.)

28035 MEASUREMENT OF THE REFRACTIVE INDEX OF LIQUID HYDROGEN. A. V. Belonogov and V. M. Gorbunkov. Opt. Spectry. (USSR) (English Transl.), 14: 234-5 (Mar. 1963).

Measurements of the refractive index of liquid parahydrogen and normal hydrogen (25% parahydrogen and 75% orthohydrogen) were made in the equilibrium state at pressures of 1 to 9 atm, with an accuracy of not less than $\pm 2 \times 10^{-4}$ and an error of no more than $\pm 1 \times 10^{-4}$. The optical scheme of the device is based on the property of a plane-parallel plate to displace the convergence point A of a homocentric beam by a quantity Δ, which is proportional to the thickness of the plate t, and to its refractive index n. Data are graphed. (P.C.H.)

28036 THE VISCOSITY OF LIQUID HELIUM 3. D. S. Betts, D. W. Osborne, B. Welber, and J. Wilks (Clarendon Lab., Oxford). Phil. Mag. (8), 8: 977-87(June 1963).

Measurements were made of the viscosity of liquid He^3 under its saturated vapor pressure in the temperature range 0.14–2.1°K. In the experiments, a polished cylinder of quartz oscillates in the liquid in its fundamental elastic torsional mode, the viscosity being obtained by observing the logarithmic decrement of the system. The resulting values of the viscosity are in agreement with those of Osborne et al., and of Taylor and Dash, but are appreciably higher than those of Zinov'eva. At lower temperatures the present results appear to extrapolate towards values consistent with the coefficients of the absorption of sound observed by Abel et al., and are not inconsistent with the $1/T^2$ dependence predicted by Landau's theory of a Fermi liquid. (auth)

28037 TWO-PARTICLE TUNNELLING BETWEEN SUPERCONDUCTORS. C. J. Adkins (Cavendish Lab., Cambridge, Eng.). Phil. Mag. (8), 8: 1051-61(June 1963).

Excess currents were observed in electron tunnelling between superconductors that cannot be explained on a model assuming the tunnelling of single particles. They take the form of a current step at applied voltages equal to half the energy gap of either superconductor, followed by an exponential-like rise in current. The size of the step varies greatly between samples and is sometimes too small to detect, but it is typically 10^{-4} of the current in the normal state at the same voltage. The excess currents are attributed to processes in which two particles tunnel simultaneously through the insulating barrier. The conditions for the occurrence of the various tunnelling processes are examined, and higher-order processes are discussed. (auth)

28038 CURVATURE OF SHOCK FRONTS IN SHOCK TUBES. P. C. T. De Boer (Univ. of Maryland, College Park). Phys. Fluids: 6: 962-71(July 1963).

Hartunian's theory for the curvature of a shock wave progressing into quiescent gas near a wall is extended to the cases of two parallel walls, of a rectangular tube, and of a circular tube. Shock curvature is considered as caused both by laminar and by turbulent boundary layers along the walls behind the shock. For a completely laminar boundary layer, the axial extent of the curved shock in the cases of two parallel walls and of a circular tube is found to be 0.760 and 0.783, respectively, of Hartunian's single wall result. The correction arising from the finite length of the boundary layer is calculated. This correction is found to be negligible provided the boundary layer length is larger than approximately one-half the distance between the walls. An estimate is presented for the correction arising from the flow behind the foot of the shock. This correction is of some importance at very low initial pressures. An approximate method is given to find the curvature of shock fronts that are followed by a relaxation region. The results obtained are in good agreement with the available experimental data. (auth)

28039 KINETIC THEORY OF MODERATELY DENSE GASES: INVERSE POWER POTENTIALS. R. F. Snider

and F. R. McCourt (Univ. of British Columbia, Vancouver). Phys. Fluids, 6: 1020-5(July 1963).

There are two effects giving rise to density corrections to the dilute gas transport coefficients. These are the corrections to the binary collisions due to their finite size and time of duration and the triple collision effect. Neglecting the latter, expressions for the transport coefficients are well known and were evaluated in the case of rigid spheres. These expressions for the transport coefficients are now simplified and evaluated approximately for inverse power potentials. The approximation consists in an expansion in inverse powers of the repulsion exponent a technique that was shown by Baroody to give good agreement with exact calculations of the Ω integrals. (auth)

28040 CONDUCTIVITY OF A SLIGHTLY IONIZED GAS. B. Durney (Compagnie General de Telegraphie Sans Fil, Orsay, France). Phys. Fluids, 6: 1027-8(July 1963).

A solution for the current density of a slightly ionized gas in an electric and magnetic field is presented in terms of the electron, ion, and neutral masses and their mean times for collision. The gradient of the electron pressure is neglected. (C.E.S.)

28041 VISUALIZATION OF THE SHOCK FRONT IN AN ELECTROMAGNETIC SHOCK TUBE. Peter Jeanmaire (Ernst-Mach-Institut, Freiburg i. B./Brunswick). Phys. Fluids, 6: 1028-9(July 1963).

The shadowgraph and schlieren-interferometer methods were used for the visualization of the shock front in an electromagnetic shock tube. The view through the channel was free in a direction vertical to the discharge along the whole length of the tube including the spark gap. The schlieren methods permit a direct observation of the shock front and are therefore appropriate to resolve the controversy on the exact position of the shock front relative to the luminous front. (C.E.S.)

28042 ANALYSIS OF A SKIMMER FOR A HIGH-INTENSITY MOLECULAR BEAM USING A THREE-FLUID MODEL. R. A. Oman (Grumman Aircraft Engineering Corp., Bethpage, N. Y.). Phys. Fluids, 6: 1030-1(July 1963).

A device using a shock tube as a source of gas and expanding the flow at the reflected-shock end of the tube through a hypersonic nozzle is described. A small portion of the flow is selected to form the molecular beam. This is accomplished by a skimmer, which is essentially a small inlet designed for maximum undisturbed transmission of the core flow. The application of a simple analytical technique to the flow near a typical skimmer operating in the near-free-molecule regime, after a very large expansion of the source flow occurs is described. A three-fluid model is employed. (C.E.S.)

28043 IONIZATION TRANSIENTS IN CESIUM. David J. BenDaniel (General Electric Research Lab., Schenectady, N. Y.). Phys. Fluids, 6: 1034-5(July 1963).

A semiquantitative model of the cesium atom was used to resolve the rapid restoration of ionization equilibrium following a transient. If during a quasi steady state of a cesium–helium discharge the current density is rapidly increased to a higher value, it is found that the transient in the voltage gradient is completed in times at least an order of magnitude shorter than would be predicted by use of the ionization cross section for an unexcited atom. It is concluded that during a transient of this nature, in which the discharge is abruptly shifted away from ionization equilibrium, the buildup of ionization occurs primarily by virtue of a multistep process involving the excited states rather than one-step collisional ionization from the ground level. (C.E.S.)

28044 EFFECT OF IMPURITIES UPON CRITICAL TEMPERATURE OF ANISOTROPIC SUPERCONDUCTORS. David Markowitz and Leo P. Kadanoff (Univ. of Illinois, Urbana). Phys. Rev., 131: 563-75(July 15, 1963).

The changes in critical temperature upon doping a superconductor are accounted for theoretically by solving a BCS-like model that includes anisotropy. This anisotropy is introduced via a factorable pairing potential that depends on the momenta of the paired particles relative to the crystal axes. The impurities have two effects upon T_c. They gradually change the gross properties of the system and, hence, produce a linear change in T_c, and in addition they abruptly reduce T_c by reducing the anisotropy of the energy gap. By adjusting parameters representing the strengths of these effects, theory was fitted to experiments on Sn, In, and Al alloy systems. We find $\langle a^2 \rangle \sim 0.01$, while valence parameters vary strongly with impurity and do not depend simply on valence. The major gap in the theory is in the unknown ratio of the mean collision times for smoothing out anisotropy and for transport. (auth)

28045 NONLINEAR MICROWAVE EFFECTS AND THE SWITCHING SPEED OF SUPERCONDUCTING TIN. A. H. Nethercot, Jr. and R. J. Von Gutfeld (International Business Machines Corp., Yorktown Heights, N. Y.). Phys. Rev., 131: 576-88(July 15, 1963).

The nonlinear response of various superconducting tin surfaces was observed when both a high-amplitude r-f magnetic field at 9200 Mc and a d-c bias field were applied to such surfaces. Harmonics at 18,400 Mc were generated because of the change of the superconducting surface resistance with field during the r-f cycle. Data are presented on the variation of this harmonic output with temperature, with d-c bias magnetic field, and with the r-f power level. Results are given for the surfaces of pure bulk specimens, of alloy bulk specimens, and of thin films of various thicknesses. The amount of harmonic power observed is never more than a few percent of that which is calculated under the assumption that the surface resistance changes instantaneously and completely from its superconducting value to its normal value when the total applied field changes from less than to more than the critical value. The conclusion is drawn that the switching between states is only partial or incomplete at such high frequencies. A discussion is given that appears to qualitatively account for most of the salient experimental facts. For the alloy and thin film specimens and for the pure specimens near T_c, this discussion is based on consideration of the Ginzburg-Landau order parameter. For the pure specimens at lower temperatures, a new approach is proposed that is based on spatial effects: The switching field is confined to such a small skin depth that the presence of the large amount of adjacent unswitched material inhibits the transition from taking place. In neither case is it found necessary to include any purely temporal limitation on the switching speed in order to explain the experimental observations. (auth)

28046 QUESTION OF SUPERCONDUCTING IRON. J. C. Suits (IBM Research Center, Yorktown Heights, N. Y.). Phys. Rev., 131: 588-91(July 15, 1963).

Iron films were evaporated in ultrahigh vacuum onto substrates cooled to liquid-helium temperature. Contrary to the results of Mikhailov et al., no evidence of superconductivity was found in these films. Vanadium films evaporated under similar conditions had superconducting transition temperatures of approximately bulk value. A

low-temperature structure modification was indicated for very thin films of iron as well as vanadium. Measurements on oxygen-doped films showed that the low-temperature structure was greatly stabilized by gaseous impurities. (auth)

28047 SUPERCONDUCTIVITY IN THE INDIUM–TIN SYSTEM. M. F. Merriam and M. Von Herzen (Univ. of California, San Diego). Phys. Rev., 131: 637-43(July 15, 1963).

Transition temperatures as a function of composition were measured throughout the In–Sn binary system. Samples quenched from the liquid state had higher transition temperatures than well-annealed samples, confirming the effect reported earlier for Hg–In compositions. The enhancement in T_c was 2-3°K for the most favorable compositions. It is argued that the effect arises from internal strains in the samples and not from short-range disorder. The equilibrium T_c values vary from 3.4 to 6.6°K. Transition temperature within any particular phase is a strong function of valence electron concentration, but not a function of the type found in transition metal superconductors. In all phases T_c increases with increasing valence electron concentration. The data in the In terminal solid solution are compared with the BCS formula, and with the theory of Morel and Anderson. A substantial variation of the electron-phonon interaction parameter with alloying is required if the data are to be described with the BCS formula. The variation in this parameter computed from the theory of Morel and Anderson is very much less than the observed variation in our case. In the tetragonal In phase a discontinuity in dT_c/dx is found at x = 8 at. % Sn. A crystallographic phase change at this composition is unlikely, and the discontinuity is thought to be an electronic effect. An apparatus for rapid and convenient measurement of transition temperatures is described. (auth)

28048 ENERGY AND ANGULAR DISTRIBUTION OF ELECTRONS EJECTED FROM HYDROGEN AND HELIUM GAS BY PROTONS. M. Eugene Rudd and Theodore Jorgensen, Jr. (Univ. of Nebraska, Lincoln). Phys. Rev., 131: 666-75(July 15, 1963).

Differential cross sections for ejection of secondary electrons of various energies at various angles were measured for hydrogen gas bombarded by 100-kev protons and for helium gas bombarded by 50, 100, and 150-kev protons. The range of angles investigated was 10 to 160° and the range of electron energies was 1 to 500 ev. A unique fixed-port, double-walled scattering chamber was used. Electrons were counted by an electron multiplier after passing through a 127° electrostatic analyzer. The efficiency of the detector was determined by replacing the analyzer and multiplier by a Faraday cup and making absolute measurements of cross sections differential only in angle. Comparison with the integral of the differential cross sections over all electron energies gave a value of about 78% for the efficiency. As a function of electron energy the cross sections decrease monotonically above about 2.5 ev and are uncertain below this value. All cross sections decrease monotonically with an increase in angle but are relatively constant above about 110°. The differential cross sections were integrated in various ways to obtain distributions over electron energy and angle, total cross sections for ionization, average energies of the ejected electrons, and the stopping cross sections due to ionization. Comparisons are made with other experimental results and with theoretical treatments by the Born approximation and the Gryzinski classical theory. (auth)

28049 CORRELATION EFFECTS IN ATOMS. Hugh P. Kelly (Univ. of California, Berkeley). Phys. Rev., 131: 684-9(July 15, 1963). (UCRL-10471)

The applicability of many-body perturbation theory in calculating electron correlations in atoms was investigated. It was found that, in order for results to agree well with experiment, certain classes of diagrams, representing terms of the perturbation series, must be included to many orders. The higher order diagrams were found to be more important in calculating correlations among the outer electrons than among inner electrons. Methods for summing various classes of these diagrams were found. The total correlation energy in beryllium was calculated by perturbation theory, by the use of an IBM 7090 computer, to be -2.48 ± 0.11 ev. The value obtained from experiment is -2.59 ev. The calculated correlation energies for the different electronic shells were found to be -1.19 ev among 2s electrons, -1.15 ev among 1s electrons, and -0.135 ev between the 1s and 2s shells. (auth)

28050 TENSOR VIRIAL THEOREMS FOR VARIATIONAL WAVE FUNCTIONS. Dave Pandres, Jr. (Lockheed-California Co., Burbank, Calif.). Phys. Rev., 131: 886-7 (July 15, 1963).

It is shown that the tensor virial theorem and certain generalizations of it are satisfied by optimum energy variational wave functions in which the variational parameters are elements of a square matrix that scales the column matrix of particle coordinates. (auth)

28051 THE DENSITY OF THE ATMOSPHERE IN THE E-REGION OF THE IONOSPHERE. J. D. Whitehead (Univ. of Sydney). Planetary Space Sci., 11: 513-21(May 1963).

Estimates of the density of the atmosphere in the E-region of the ionosphere using a variety of techniques range over a factor of about 30. Current models likewise give values ranging over a factor of six, and it is of interest therefore to compare the various estimates and assess their reliability. The methods considered are direct density or pressure measurements by gages and mass spectrometers carried in rockets, the measurement of x-ray fluxes, the diffusion of artificial sodium clouds and meteor trails, densities deduced from electron collision frequencies, and from an estimate of ion collision frequency from a sporadic E-region study. The evidence suggests that the latest gage results are likely to be the most reliable of these, but the study points the need for a special low orbiting satellite to measure this important parameter in E-region. (auth)

28052 STABLE 6300 Å AURORAL ARCS IN MID-LATITUDES. F. E. Roach (Central Radio Propagation Labs., Boulder, Colo.) and J. R. Roach. Planetary Space Sci., 11: 523-45(May 1963).

A review is given of the properties of newly discovered photometric arcs that have some of the characteristics of an aurora although their occurrence equator-ward of visual auroras places them in a distinct category. Following a description of the morphology and dynamics of the arcs, speculations are advanced concerning possible sources of excitation. (auth)

28053 RETARDED POTENTIALS AND THE EXPANSION OF THE UNIVERSE. D. W. Sciama (Cambridge Univ., Eng.). Proc. Roy. Soc. (London), Ser. A, 273: 484-95(June 11, 1963).

The observed irreversibility of radiation processes is traced to the asymmetry in time of the expanding universe. A similar idea was recently proposed by Hogarth, who applied the Wheeler-Feynman theory to various world-models in an attempt to discriminate between advanced and retarded potentials. Hogarth found that, while the steady-

state model leads to the required retarded potentials, the Einstein–deSitter model leads to advanced potentials. In addition to disagreeing with observation, this latter result implies that a uniform distribution of galaxies can give rise to an infinite intensity of radiation. By contrast, work with the conventional Maxwell theory is presented. By using Kirchhoff's boundary-value formulation of this theory, the boundary conditions appropriate to non-static world-models can be introduced. In the Einstein–deSitter model there exist distributions of sources for which Maxwell's theory leads to retarded potentials. In these cases the Wheeler–Feynmann theory breaks down. The actual galaxies may constitute such a distribution. In the steady-state model Maxwell's theory is equivalent to the Wheeler–Feynmann theory, and leads to retarded potentials. In this case there is no source-free radiation, in agreement with the observational data. (auth)

28054 CHARGE TRANSFER AND IONIZATION BY POSITIVE IONS IN THE ENERGY RANGE 60 TO 450 kev. H. B. Gilbody, J. B. Hasted, J. V. Ireland, A. R. Lee, E. W. Thomas, and A. S. Whiteman (University Coll., London). Proc. Ray. Soc. (London), Ser. A, 274: 40-54 (June 25, 1963).

Charge transfer and ionization by singly charged positive ions were investigated by means of a variation of the well-known condenser method in which slow charge collection over a precisely determined path length is carried out at pressures low enough to ensure single collision conditions; a uniform axial magnetic field enables total slow ion currents to be measured. The apparent total charge transfer cross-section, the total electron production cross-section, and the total slow ion production cross-section were determined for seventeen cases involving rare gas ions in the rare gases and hydrogen. (auth)

28055 THE GROWTH OF OUR KNOWLEDGE OF THE EARTH'S OUTER RADIATION BELT. T. A. Farley (Univ. of California, Los Angeles). Rev. Geophys., 1: 3-34(Feb. 1963).

The development of our knowledge of the outer Van Allen radiation zone is surveyed. The early discoveries of the gross features of the radiation belt, the difficulties encountered in determining the electron energy spectrum, and the misinterpretation of geomagnetic storm intensity changes due to inadequate knowledge of the electron spectrum are discussed. Also considered are the equatorial pitch angle distributions of electrons, the presence of protons in the outer zone, and the question of a slot between the inner and outer zones. The calculations of the neutron albedo contribution of electrons to the outer zone are reviewed; the contribution appears to be inadequate, because the resulting energy spectrum is incorrect, the intensity inadequate, and the required lifetime too long. Observations of electron precipitation into the atmosphere are reviewed, and several possibilities for the connection of such observations to the intensity and lifetimes of trapped electrons are listed. (auth)

28056 PREPARATION OF MONOCRYSTALS OF POTASSIUM IODIDE ACTIVATED BY THALLIUM. A. Fernández and E. Muñoz (Universidad Nacional, Mexico [City]). Rev. Mex. Fis., 11: 255-8(1962). (In Spanish)

A qualitative process is discussed for the growth of crystals beginning with the flux. In order to carry out the process a modified version of the Kyropoulos principle is used, by which a crystal is obtained with characteristics and dimensions suitable for use with a nuclear particle detector. (tr-auth)

28057 SEMIGRAPHICAL SOLUTION OF FOCUSING AND TRANSMISSION OF QUADRUPOLE LENS SYSTEMS. James Draper (Yale Univ., New Haven). Rev. Sci. Instr., 34: 679-84(June 1963).

A semigraphical method is presented for evaluating the focusing conditions and the acceptance solid angle of quadrupole lens systems. The method is illustrated for a specific triplet magnetic quadrupole system for which the predictions are confirmed experimentally. (auth)

28058 VACUUM PROPERTIES OF SILVER CHLORIDE. George Martin (Princeton Univ., N. J.). Rev. Sci. Instr., 34: 707-8(June 1963).

An outgassing study of AgCl was conducted using an ultra-high vacuum system and a mass spectrometer. The system was baked before the heating experiments. Mass peaks of HCl were detected, and the partial pressure of HCl was measured to be 4.9×10^{-9} and 44×10^{-9} Torr at 200 and 300°C, respectively. A 2-in. dia LiF window sealed with AgCl was also tested; it was found to have a high production rate of HCl before baking. (D.L.C.)

28059 SCINTILLATION OF LIQUID ARGON PRODUCED BY 10–50 Mev PROTONS. R. A. Giles and E. J. Burge (King's Coll., London). Rev. Sci. Instr., 34: 709-10 (June 1963).

A liquid target cell was designed which uses a quartz window, Invar steel, and p-quarterphenyl as wavelength shifter. The response of liquid argon in this cell was measured for protons of energy up to 50 Mev, and a graph of the pulse height vs. energy calibration is given. The resolution needs to be improved. (D.L.C.)

28060 IONOSPHERIC RESEARCH FROM SPACE VEHICLES. R. E. Bourdeau (Goddard Space Flight Center, Greenbelt, Md.). Space Sci. Rev., 1: 683-728(May 1963). (In English)

Available interdisciplinary experimental data are compared with theoretical models of the D, E, and F regions and the upper ionosphere, selecting those models that best fit the spaceflight observations. Because a significant amount of low-energy charged particle data was obtained by direct sampling techniques and because this methodology is relatively new to ionospheric research, brief descriptions of the validity of some of these results are discussed. (C.E.S.)

28061 GAMMA ASTRONOMY. E. Schatzman (Institut d'Astrophysique, Paris). Space Sci. Rev., 1: 774-80(May 1963). (In French)

It is possible to predict the amount of gamma rays that are produced in various astronomical objects, that is, gamma rays due to nuclear reactions, to bremsstrahlung, to cosmic rays, to annihilation of matter and anti-matter. These predictions are compared to the results of the observations with Explorer XI and are used to suggest new experiments. Experiments to measure the γ flash associated with Supernovae; to study the energy spectrum of γ rays from radio-sources; to study the γ rays produced in the galaxy, in the halo, and in extragalactic nebulae are suggested. The weight of the instruments is sufficiently low to put γ astronomy among the immediate program of European space research. (auth)

28062 THE EMISSION SPECTRUM OF PROTACTINIUM IN THE 0.8 – 3.0 μ REGION. E. W. T. Richards and N. J. Atherton (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Spectrochim. Acta, 19: 971-87 (June 1963). (AERE-R-3851)

The emission spectrum of Pa^{231} from an electrodeless discharge tube was observed in the region of 0.8 to 3.0 μ.

Wavelengths and intensities were measured for about 1200 lines, many of which show hyperfine structure. (auth)

28063 INVESTIGATION OF THE DIRECTIVITY OF THE LASER OUTPUT. M. P. Vanyukov, V. I. Isaenko, and V. A. Serebryakov (State Inst. of Optics, USSR). Zh. Eksperim. i Teor. Fiz., 44: 1493-6(May 1963). (In Russian)

It is found experimentally that the stimulated radiation from lasers with square, rectangular, and octahedral cross sections may be distributed over several discrete directions. The existence of such directions is ascribed to the formation of additional closed paths of the rays, which result from multiple reflection at the parallel lateral walls. (auth)

28064 ON CENTRAL-SYMMETRIC GRAVITATIONAL FIELDS. A. Z. Petrov (Kazan State Inst.). Zh. Eksperim. i Teor. Fiz., 44: 1525-33(May 1963). (In Russian)

It is shown that the statement that any central-symmetric gravitational field in vacuum should be a static field is true only under some additional conditions. These conditions are equivalent to certain assumptions regarding the wave properties of the Einstein field equation solutions. A general solution of the problem is presented. (auth)

28065 ON THE LIMITS WHICH DETERMINE THE POSSIBILITY OF MEASURING GRAVITATIONAL EFFECTS. V. B. Braginskii (Moscow State University). Zh. Eksperim. i Teor. Fiz., 44: 1562-6(May 1963). (In Russian)

Conditions that must be met in measuring gravitational effects on the basis of the motion of test masses are formulated. The maximal accuracy of measurement of gravitational effects that can be attained in principle is determined by the very low fluctuation level of the gravitational field. The possibility of diminishing nongravitational fluctuations resulting from mechanical forces acting on the test masses is considered, and the level of gravitational radiation that can be detected is estimated. (auth)

28066 ATTENUATION OF MAGNETOACOUSTIC AND THE WIDTH OF SHOCK WAVES IN ANISOTROPIC RELATIVISTIC MAGNETIC HYDRODYNAMICS. R. V. Doich (Univ. of Cluj). Zh. Eksperim. i Teor. Fiz., 44: 1640-3 (May 1963). (In Russian)

The basic equations of anisotropic relativistic magnetohydrodynamics are formulated. The problem of attenuation of weak magnetoacoustic waves is considered, on the basis of the equations and the relation between the attenuation coefficients of weak magnetoacoustic waves. The width of weak shock waves is derived. (auth)

28067 SOME FEATURES OF THE THRESHOLD BEHAVIOR OF THE CROSS SECTIONS FOR EXCITATION OF HYDROGEN BY ELECTRONS DUE TO THE EXISTENCE OF A LINEAR STARK EFFECT IN HYDROGEN. M. Gailitis and R. Damburg (Inst. of Physics, Academy of Sciences, Latvian SSR). Zh. Eksperim. i Teor. Fiz., 44: 1644-9(May 1963). (In Russian)

In the case of short-range forces, the energy dependence of the cross sections for inelastic transitions near the threshold (providing a particle in the final state is charged) is a function of k_f and l_f (the momentum and angular momentum in the final state). If $l_f = 0$ the cross sections in the old channels at the threshold energy possess a singularity of the peak or step type. It is shown that upon excitation of the H atom by electrons these laws are violated because of the strong polarization interaction between the electron moving away and the hydrogen atom in the excited state. The cross sections near the threshold oscillate. The inelastic cross sections tend to zero only at energies of the order of the relativistic splitting between the levels. (auth)

28068 SHAPE OF THE MAGNETIZATION CURVE OF SUPERCONDUCTING ALLOYS NEAR THE SECOND CRITICAL FIELD. V. V. Shmidt (Baikov Inst. of Metallurgy). Zh. Eksperim. i Teor. Fiz., 44: 1675-8(May 1963). (In Russian)

The conclusions of a theory regarding the shape of the magnetization curves of superconducting alloys near the second critical field are compared with experimental data. The latter are preliminarily treated in a requisite manner. Agreement between theory and experiment is found. (auth)

28069 THEORY OF A SUPERCONDUCTING FERMI FLUID. APPLICATION TO THE NUCLEUS. A. I. Larkin and A. B. Migdal. Zh. Eksperim. i Teor. Fiz., 44: 1703-18(May 1963). (In Russian)

A method for analyzing systems of strongly interacting particles is presented, in which observable quantities are expressed in terms of several constants, which are introduced into the theory in a manner similar to that by which particles, masses, and charges are introduced into the dispersion relation theory. The Landau theory of Fermi fluids is extended to the superfluidity case and to systems with a finite size. An equation is deduced that yields the probabilities of electromagnetic transitions in nuclei. (auth)

28070 MAGNITNAYA GIDRODINAMIKA. (Magnetohydrodynamics). A. G. Kulikovskii and G. A. Lyubimov. Moscow, Fizmatgiz, 1962. 248p.

Fundamental results and qualitative effects and mechanisms that arise during interactions of conducting fluids with an electromagnetic field are presented. Particular attention is given to the derivation and analysis of explicit solutions for magnetohydrodynamic equations. Problems that arise when these solutions fail are also analyzed. The limits of applicability for the magnetohydrodynamic equations are brought out in detail. Graphic physical explanations and distinct formulation of various phenomena are presented where possible. Results of experimental research are also given. Motion of incompressible fluids, simple wave and small disturbances, surface discontinuities, stationary and nonstationary motion of ideal gases, stationary motion of nonideal gases, and conducting fluid flow around magnetized solids are the topics covered. (C.E.S.)

28071 PROKHOZHDENIE ZARYAZHENNYKH CHASTITS CHEREZ VESHCHESTVO. (Passage of Charged Particles Through Matter). S. V. Starodubev and A. M. Romanov. Tashkent, Uzbek SSR, Publishing House of the Academy of Sciences, 1962. 228p.

The theory and numerous experimental results for the reactions of charged particles with matter and the passage of charged particles and electrons through matter are presented. Problems of energy losses, ionization processes, and energy-range correlations for charged particles are considered. (C.E.S.)

28072 ADVANCES IN CRYOGENIC ENGINEERING. VOLUME 8. Proceedings of the 1962 Cryogenic Engineering Conference, University of California, Los Angeles, California, August 14-16, 1962. K. D. Timmerhaus, ed. A Cryogenic Engineering Conference Publication. New York, Plenum Press, 1963. 708p. $17.50.

Reports ranging over the whole field of cryogenics including cryopumping, thermodynamics, properties of

materials, superconductivity, space problems and insulation are presented. Other topics include refrigeration equipment, instrumentation, equipment and processes, and heat, mass, and momentum transfer. Separate abstracts were prepared for 30 of the 82 papers presented. Two papers were previously abstracted in NSA (16: 10546 and 17: 3582). (C.E.S.)

28073 TEMPERATURES BELOW 1°K. N. Kurti (Oxford Univ.). Advan. Cryog. Eng., 8: 1-10(1963).

Equations for the limiting temperature of an evaporative cryostat using helium-3 were derived. The basic formulas for cooling by isentropic demagnetization of electron spins, their derivation, and their limitations are presented analogous to those for the adiabatic expansion of gases. Magnetic cooling and its application to continuous refrigeration and cryopumping is discussed. Nuclear cooling and the conditions under which it is possible to cool the conduction electrons, the lattice, and materials into the microdegree temperature range are considered. (C.E.S.)

28074 HIGH-FIELD SUPERCONDUCTING MAGNETS. J. K. Hulm, B. S. Chandrasekhar, and H. Riemersma (Westinghouse Research Labs., Pittsburgh). Advan. Cryog. Eng., 8: 17-29(1963).

The niobium-zirconium alloys typified by body-centered-cubic systems are considered for use in high-field superconducting magnets. Superconducting properties of Nb–Zr alloys are presented. Power requirements for normal and superconducting high-field magnets are compared. Solenoid critical currents and the characteristics and applications of the high-field superconducting magnet are discussed. (C.E.S.)

28075 THE COMBINED USE OF LIQUID AND GASEOUS HELIUM TO PROVIDE NEAR ACTUAL SPACE ENVIRONMENT. H. Mark and R. D. Sommers (Lewis Research Center, Cleveland). Advan. Cryog. Eng., 8: 93-99 (1963).

A facility was designed, built, and successfully operated that has as its purpose the reproduction of the interplanetary space environment. Gaseous and liquid helium are used as refrigerant. During operation liquid helium fills a jacket that completely surrounds the space volume and maintains the wall at liquid helium temperature. Gaseous helium is circulated through the system to reduce material temperatures to 35°K before pouring the liquid. The solar electromagnetic radiation spectrum, the low pressure and density in space, and the black radiation sink of space are simulated. Runs of 8 hours were made with solar radiation, 4°K background, and pressure less than 10^{-13} mm Hg. (C.E.S.)

28076 THE THERMODYNAMIC PROPERTIES OF PARAHYDROGEN FROM 1° TO 22°K. J. C. Mullins, W. T. Ziegler, and B. S. Kirk (Georgia Inst. of Tech., Atlanta). Advan. Cryog. Eng., 8: 116-25(1963).

A consistent set of thermodynamic properties for parahydrogen from 22°K to a temperature at which the vapor pressure of solid hydrogen is ~10^{-6} mm Hg was presented. These data were used to construct a temperature-entropy diagram, having lines of constant enthalpy, constant pressure, constant volume, and constant quality. Such a chart is useful in the engineering analysis of processes involving the venting of saturated liquid and gaseous parahydrogen into space environments in which pressures as low as 10^{-6} mm Hg may be encountered. Extension of the calculations to 1°K was carried out. (C.E.S.)

28077 VOLUMETRIC BEHAVIOR OF GAS MIXTURES AT LOW TEMPERATURES BY THE BURNETT METHOD: THE HELIUM–NITROGEN SYSTEM, 0° TO –140°C. F. B. Canfield, T. W. Leland, and R. Kobayashi (Rice Univ., Houston, Tex.). Advan. Cryog. Eng., 8: 146-57(1963).

The volumetric behavior of the helium-nitrogen system from 0 to –140°C as determined by the Burnett method is reported. The second, second interaction, third, and third interaction virial coefficients for helium, nitrogen, and six mixtures are obtained. The experimental helium and nitrogen compressibility factors are compared with previous investigations. It is concluded that the Burnett apparatus is an accurate method for obtaining low-temperature gas compressibility data and second virial coefficients. (C.E.S.)

28078 LIQUID HELIUM AND NITROGEN SUPPLY SYSTEMS FOR SPACE SIMULATORS. J. L. Aberle and A. J. Westbrock (Linde Co., Tonawanda, N. Y.). Advan. Cryog. Eng., 8: 190-8(1963).

Cryogenic systems required to simulate the cold heat sink and the high vacuum of space are discussed. The space heat sink is simulated by the use of liquid nitrogen as a refrigerant in panels utilizing either a boiling or subcooled circulation system. A simple liquid-nitrogen supply system is shown. A discussion of the comparative merits of diffusion pumping and cryopumping using liquid helium as applied to vacuum simulation chambers is presented. Two large helium refrigeration systems operating at 20 and 4.2°K levels are described. (C.E.S.)

28079 A CLOSED-CYCLE CASCADE HELIUM REFRIGERATOR. P. K. Lashmet and J. M. Geist (Air Products and Chemicals, Inc., Allentown, Penna.). Advan. Cryog. Eng., 8: 199-205(1963).

A closed-cycle cascade helium refrigerator developed for supplying a minimum of 750 mw of useful refrigeration at 4.4°K is described. The system, which utilizes the Joule-Thomson cooling effect to obtain low temperatures, is self-contained and simple to operate. It is suitable for providing reliable, low-temperature refrigeration for extended periods of time for those applications in which refrigerator size and weight are not restrictive. (C.E.S.)

28080 A CLOSED-CYCLE HELIUM REFRIGERATOR FOR 2.5°K. K. Zeitz and B. K. Woolfenden (Air Products and Chemicals, Inc., Allentown, Penna.). Advan. Cryog. Eng., 8: 206-12(1963).

The design features and operating characteristics of a helium closed-cycle refrigerator for producing 200 mw of refrigeration at 2.5°K are described. The basic unit was developed for maser cooling applications, but is very suitable for computer and cryogenic magnet applications. The unit has cooled down to 2.5°K in less than 3 hr and is designed to operate for up to 3 months without maintenance. Equipment needing maintenance can be replaced with plug-in connections. The cryostat containing heat exchangers, expansion engines, and all gas controls weighs approximately 150 lb. The compressor package also weighs approximately 150 lb. (C.E.S.)

28081 HAZARDS IN THE HANDLING OF CRYOGENIC FLUIDS. M. G. Zabetakis (Bureau of Mines, Pittsburgh). Advan. Cryog. Eng., 8: 236-41(1963).

The properties of the materials used to confine low-temperature fluids and gases, and the response of the human body to both the fluids and vaporized gases and to the ambient atmospheres are considered in connection with the hazards that may be encountered in handling cryogenic fluids such as liquid helium, hydrogen, neon, nitrogen, carbon monoxide, fluorine, argon, oxygen, methane, and krypton. Since compressed gases usually play an important part in the production of these fluids, the general safety precau-

tions to be observed in their handling, storage, and use are also considered. (C.E.S.)

28082 THERMAL CONDUCTIVITY OF SOLID H_2O AND D_2O AT LOW TEMPERATURES. J. W. Dean and K. D. Timmerhaus (CEL National Bureau of Standards, Boulder, Colo.). Advan. Cryog. Eng., 8: 263-7(1963).

Engineering values of the thermal conductivity of light and heavy ice near liquid nitrogen and hydrogen temperatures were determined. The temperature range 20–23.6°K was investigated with liquid hydrogen and 77–103°K with liquid nitrogen as refrigerant. Values obtained for the heavy ice were consistently 5 to 10% lower than those for light ice at the same temperature. (C.E.S.)

28083 THE WETTING OF SOLIDS BY LIQUID HYDROGEN. R. J. Good and G. V. Ferry (General Dynamics/Astronautics, San Diego, Calif.). Advan. Cryog. Eng., 8: 306-10(1963).

The wetting of certain practical construction materials by liquid hydrogen was investigated. A theoretical treatment indicated that quantum mechanical effects should influence the interfacial tension between liquid hydrogen and any solid. The contact angle between the liquid hydrogen and the material was measured by a modification of the Langmuir-Shaeffer method. (C.E.S.)

28084 SOLID FORMATION IN FLOWING CRYOGENIC FLUIDS. D. B. Chelton, B. W. Birmingham, and J. W. Dean (CEL National Bureau of Standards, Boulder, Colo.). Advan. Cryog. Eng., 8: 311-14(1963).

An investigation of conditions under which liquid oxygen and hydrogen form solid and metastable liquid when expanded below their triple-point pressures with a reduction of temperature is reported. Various geometries of larger-diameter glass tubes were used to simulate leaking or partially open valves in lines exposed to low environmental pressures. It is shown that the formation of solids may restrict flow and cause problems in critical areas. Variables such as the heat capacity of pipe or vent, the film resistance to heat flow at solid hydrogen and structure interface, the heat transfer to the plugging area, and the geometry and flow in the pipe or vent influence the solid formation. (C.E.S.)

28085 A SURVEY OF MASS AND LEVEL GAUGING TECHNIQUES FOR LIQUID HYDROGEN. W. A. Olsen (Lewis Research Center, Cleveland). Advan. Cryog. Eng., 8: 342-59(1963).

A brief description of sensors by which the liquid mass of hydrogen contained in a tank can be gaged is presented. Schematic drawings of the principle of operation are given for continuous-reading, total-content sensors, continuous-reading, interface-following sensors, point-reading, nulled continuous sensors, and point-reading, point-sampling sensors. All of the sensors depend upon the normally large difference of some property across the interface between the liquid and the gas above it. (C.E.S.)

28086 A COMPARATIVE STUDY OF AIRBORNE LIQUID-HYDROGEN TANK INSULATION. J. L. McGrew (Martin-Marietta Corp., Denver). Advan. Cryog. Eng., 8: 387-92(1963).

Propellant system insulation for missiles utilizing liquid hydrogen is discussed. For application to airborne vehicles the product of thermal conductivity and density is a very useful parameter and is listed for various insulating materials. Conditions encountered in prelaunch, boost, and space environment must be considered in design and tailored to fit the requirements of the mission. (C.E.S.)

28087 EXTERNAL INSULATION TECHNIQUES FOR LIQUID-HYDROGEN TANKS. H. K. Merrill and D. W. Murphy (Martin-Marietta Corp., Denver). Advan. Cryog. Eng., 8: 393-7(1963).

The evaluation of two external insulation concepts for liquid hydrogen tanks that might meet long-term space requirements is presented. The insulation is evaluated for adequate performance on the ground and effectiveness in space. The two concepts consisted of eight layers of fiberglass and aluminum foil covered with an aluminum shroud and purged with helium gas to prevent air condensation in the insulation and corkboard bonded to the tank and covered with fiberglass matting to simulate multilayer insulation. (C.E.S.)

28088 EXPERIMENTAL PERFORMANCE OF MODEL LIQUID-HYDROGEN SPACE TANKAGE WITH A COMPRESSIBLE SUPERINSULATION. C. R. Lindquist and L. R. Niendorf (Linde Co., Tonawanda, N. Y.). Advan. Cryog. Eng., 8: 398-403(1963).

Superinsulations, which require very low residual gas pressure in the interstices for proper thermal performance, are applicable when in the vacuum environment of outer space. Design compromises are made to obtain satisfactory performance in the atmosphere. The insulation volume is encapsulated within a hermetically sealed, flexible plastic jacket and evacuated to the required degree of vacuum. An external bearing pressure of 1 atm compresses the insulation and increases its thermal conductivity. Large-scale tests in liquid-hydrogen service using model space tankage are described. (C.E.S.)

28089 AN INVESTIGATION OF THE USE OF INTERNAL INSULATION FOR LIQUID-HYDROGEN-FUELED MISSILES. E. F. Coxe, R. O. Lowrey, R. T. Hunt, and S. M. Freeman (Lockheed-Georgia Co., Marietta). Advan. Cryog. Eng., 8: 404-10(1963).

Major problems involved in the use of plastic foams are discussed along with areas where additional attention must be given if a high measure of reliability with this type of insulation is to be achieved. Emphasis is placed on the internal insulation concept. The higher skin temperature that would occur on the externally insulated tank of launch vehicles during aerodynamic heating would render unsatisfactory many of the otherwise acceptable foams. The insulation system considered was a plastic foam bonded to the inside of the propellant tank wall and covered by a vapor barrier bonded to the foam. (C.E.S.)

28090 FOAMS AND PLASTIC FILMS FOR INSULATION SYSTEMS. R. N. Miller, C. D. Bailey, R. T. Beall, and S. M. Freeman (Lockheed-Georgia Co., Marietta). Advan. Cryog. Eng., 8: 417-24(1963).

In order to facilitate the development of insulation systems for rockets using cryogenic propellants, the properties of a number of foams, plastic films, and adhesives were determined at 37, 140, and 530°R. Vapor barrier materials were evaluated for load compression, flatwise tension, and lap shear strength. Thermal expansion properties were determined for thirteen materials. (C.E.S.)

28091 CRYOSTATS FOR IRRADIATING AT 4.2°K. F. H. Eisen (Atomics International, Canoga Park, Calif.). Advan. Cryog. Eng., 8: 437-42(1963).

Two cryostats, one for semiconductors and the other for metals, that were used for electron irradiations at liquid helium temperature and for subsequent annealing of the sample in situ are described. Basically the same type of heater and temperature control system is used in both cryostats. The good low-temperature thermal conductivity

of sapphire is used in both devices to provide an element that is a thermal conductor and an electrical insulator. Both cryostats can be attached to a van de Graaff accelerator. (C.E.S.)

28092 A He^3 CRYOSTAT FOR PERFORMING EXPERIMENTS WITH ORIENTED NUCLEI. E. Ambler, R. B. Dove, and R. S. Kaeser (National Bureau of Standards, Washington, D. C.). Advan. Cryog. Eng., 8: 443-5(1963).

A liquid-helium-3 cryostat for experiments with oriented nuclei is described that is portable and self-contained, can be recycled quickly, continuously operating, and able to cope with as large a heat flow as possible. The lower part of the apparatus surrounding the target is designed so as to allow passage of the beam from the accelerator. It is also demountable in order to be used with various particle accelerators without altering the main cryogenic features of the apparatus. (C.E.S.)

28093 PERFORMANCE OF AN INDUCER-IMPELLER COMBINATION AT OR NEAR BOILING CONDITIONS FOR LIQUID HYDROGEN. W. W. Wilcox, P. R. Meng, and R. L. Davis (Lewis Research Center, Cleveland). Advan. Cryog. Eng., 8: 446-55(1963).

The overall performance, both cavitating and noncavitating, of a 76° flat plate helical inducer in combination with a centrifugal rotor is presented. The tests are performed in liquid hydrogen at or near boiling conditions. (C.E.S.)

28094 PEAK HEAT FLUX AND TEMPERATURE DIFFERENCE IN NUCLEATE BOILING OF LIQUEFIED GASES. T. H. K. Frederking (Univ. of California, Los Angeles). Advan. Cryog. Eng., 8: 489-94(1963).

The conditions determining the peak nucleate boiling heat flux and the accompanying temperature difference that are important for the design and operation of cryogenic systems are discussed. The discussion is restricted to a one-component system and normal cryogenic liquids. (C.E.S.)

28095 NUCLEATE BOILING HEAT-TRANSFER DATA FOR LIQUID HYDROGEN AT STANDARD AND ZERO GRAVITY. J. E. Sherley (General Dynamics/Astronautics, San Diego, Calif.). Advan. Cryog. Eng., 8: 495-500(1963).

Zero-g nucleate boiling heat transfer tests were performed to study the action of boiling liquid hydrogen on the face of a heated surface and to determine the heat flux as a function of the temperature in both one-g and zero-g environments. Visual observation of boiling for a range of heat fluxes between 250 and 7000 Btu/hr-ft^2 showed that the bubbles formed at the heated surface coalesced and the surface tension forces were sufficient to rewet the surface behind the bubble. Data indicated that the zero-g nucleate boiling heat transfer is approximately the same as one-g boiling heat transfer results for the particular test-specimen orientation used throughout the tests and for the zero-g test duration times available. (C.E.S.)

28096 EXPERIMENTAL INVESTIGATION OF LIQUID-HYDROGEN COOLING BY HELIUM GAS INJECTION. A. F. Schmidt (CEL National Bureau of Standards, Boulder, Colo.). Advan. Cryog. Eng., 8: 521-8(1963).

The practicability of subcooling cryogenic liquids by injecting a noncondensable gas of low solubility into the liquid is shown in the investigation of liquid hydrogen cooling by helium gas injection. The process is one of evaporative cooling. Temperature history, cooling rate, and minimum temperature may be predicted for the liquid with a good degree of accuracy. (C.E.S.)

28097 SOME IDEALIZED SOLUTIONS FOR CHOKING, TWO-PHASE FLOW OF HYDROGEN, NITROGEN, AND OXYGEN. R. V. Smith (CEL National Bureau of Standards, Boulder, Colo.). Advan. Cryog. Eng., 8: 563-73(1963).

Equations and their numerical solutions for choking flow of liquid-vapor mixtures of hydrogen, nitrogen, and oxygen are presented. Three models of saturated, two-phase fluid flow, the homogeneous, thermal equilibrium model, the separated-phase, vapor-choking model, and the homogeneous, metastable model are analyzed. Several assumptions were made regarding the flow patterns and liquid-vapor equilibrium. Curves from the idealized solutions are shown for comparison with experimental values. The flow models were selected so that the analytical results would bracket actual flow cases. (C.E.S.)

28098 INFLUENCE OF MECHANICAL CONSTRAINTS ON THE SUPERCONDUCTING TRANSITION OF Nb_3Sn-COATED NIOBIUM WIRES AND RIBBONS. C. B. Mueller and E. J. Saur (Universität, Giessen, Ger.). Advan. Cryog. Eng., 8: 574-8(1963).

Mechanical constraints such as pull, torsion, bending, and uniaxial pressure on Nb_3Sn layers on niobium wires result in a systematic shift of the critical temperature to lower values. The transition interval increases. An almost parabolic relation exists between the applied constraint and the reduction of the critical temperature. Similar results were obtained for samples with V_3Ga layers. (C.E.S.)

28099 AC LOSSES IN HARD SUPERCONDUCTORS. C. H. Jones and H. L. Schenk (Westinghouse Research Labs., Pittsburgh). Advan. Cryog. Eng., 8: 579-84(1963).

Superconducting coils of hard-drawn Nb-Zr wires were found to exhibit losses when carrying a-c currents or when placed in a-c magnetic fields. The presence of d-c fields ranging from 5000 to 20,000 oersteds was found to increase the losses. An empirical expression for the loss was determined. (C.E.S.)

28100 THEORETICAL AND EXPERIMENTAL STUDY OF AN UNPROTECTED SUPERCONDUCTING COIL GOING NORMAL. Z. J. J. Stekly (Avco-Everett Research Lab., Everett, Mass.). Advan. Cryog. Eng., 8: 585-600(1963).

The thermal and electrical transients that occur when a region of superconducting coil goes normal are investigated. The decay transient in a superconducting coil wound in series with no protective circuitry is predictable starting from data on the propagation of the normal region in a single wire, provided it is recognized that the normal region propagates to adjacent turns. The characteristic decay time depends on the ratio of velocity of propagation in the direction perpendicular to the conductor to that along the conductor. (C.E.S.)

28101 SUPERCONDUCTING CRITICAL CURRENTS IN WIRE SAMPLES AND SOME EXPERIMENTAL COILS. R. C. Wolgast, H. P. Hernandez, P. R. Aron, H. C. Hitchcock, and K. A. Solomon (Univ. of California, Berkeley). Advan. Cryog. Eng., 8: 601-7(1963).

Superconducting critical currents were determined for wires of Nb-Zr, Nb-Ti, and Ta-Ti alloys. The measurements were made at 4.2°K for various coil geometries. (C.E.S.)

28102 TENSILE, COMPRESSION, AND SHEAR LOOP FOR IRRADIATION TESTING AT CRYOGENIC TEMPERATURES. G. V. Aseff, Sr., R. F. Callaway, and A. M. Liebschutz (Lockheed-Georgia Co., Dawsonville). Advan. Cryog. Eng., 8: 624-30(1963).

The developmental testing programs associated with the tensile-compression irradiation test loop that is used to obtain mechanical property data on 25 space-related alloys under the combined environment of cryogenic temperatures

to 30°R, a maximum integrated neutron dose of 10^{19} nvt, and stress to failure are presented. Yield strength values are given for stainless steels and aluminum and titanium alloys. (C.E.S.)

28103 METHODS OF AND APPARATUS FOR GENERATING ELECTRICAL ENERGY. Agust Valfells. British Patent 927,770. June 6, 1963. Priority date Apr. 3, 1961, United States.

A device for converting nuclear energy into electrical involves passing a gas composed of a fissionable isotope and an easily ionizable substance through a fission chamber Fission of the isotope heats and ionizes the gas, which expands and streams across a magnetic field. The current induced in the gas can then be drawn off by electrodes in the gas stream or in the magnetohydrodynamic generator. (D.C.W.)

28104 ENERGY STORAGE DEVICE. Charles H. Blakewood, Donald C. Reynolds, and Douglas M. Warschauer (to U. S. Air Force). U. S. Patent 3,093,735. June 11, 1963. Filed Jan. 22, 1960.

An energy storage device consisting of a cadmium sulfide crystal cooled to very low temperatures is described. Energy can be stored by thermal means or by irradiation with light up to 6900 Å, and energy can be released by mechanical tapping or by application of a signal to an electro-mechanical transducer. Several means for sensing the energy release are also provided. (D.C.W.)

Astrophysics and Cosmology

28105 CORONAL OBSERVATIONS AND ROCKET SOLAR ULTRAVIOLET RESULTS. Harold Zirin (High Altitude Observatory, Boulder, Colo). AIAA (Am. Inst. Aeron. Astronaut.) J., 1: 1286-9(June 1963).

Observations of the extreme ultraviolet (EUV) spectrum of the sun made from outside the earth's atmosphere have enabled astronomers to supplement knowledge of the solar corona obtained by observation in the visual and near infrared region with coronagraphs. Since the solar spectrum below 500 Å arises primarily in the corona, EUV observations permit observation of the corona directly on the disk. On the basis of the knowledge of changes in the general temperature of the corona, the EUV spectrum is expected to change in the course of the solar cycle. Some short-term changes already were observed at the time of solar flares. Particularly large effects are found in the near x-ray region. Observations of the EUV spectrum, combined with ground based observation give new information on the structure of the chromosphere-corona transition zone. (auth)

28106 EVIDENCE FOR AN EXPLOSION IN THE CENTER OF THE GALAXY M82. C. R. Lynds (Kitt Peak National Observatory) and A. R. Sandage. Astrophys. J., 137: 1005-21(May 15, 1963).

New observations in optical frequencies of the peculiar optical and radio galaxy M82 reveal a massive system of filaments that extends along the minor axis to a height of 3000 pc above and below the fundamental plane. Emission lines typical of low-excitation gaseous nebulae are present. The filaments on both sides of the plane appear to be expanding from the center along the minor axis with velocities ranging up to about 1000 km/sec. The data suggest that an expulsion of matter took place from the central regions of M82 about 1.5×10^6 years ago. The Hα emission flux from the filaments is estimated to be 1.7×10^{-11} erg cm^{-2} sec^{-1} at the earth's surface, which requires a total emitted power of 2×10^{40} ergs sec^{-1} in Hα if the distance modulus of M82 is m − M = 27.5. The ion density in the filaments, estimated from the volume emissivity, is 10 protons cm^{-3}, which then requires the mass of the expanding material to be 5.6×10^6 M ⊙ as an upper limit. An upper limit to the kinetic energy of the moving gas is 2.4×10^{55} ergs. The filaments form fragments of loops and appear to outline lines of magnetic force. Parts of the filaments appear to radiate weakly in the continuum, as well as in the emission lines, and this suggests that optical synchrotron radiation may be present. Polarization measurements of part of the filamentary structure by Elvius and Hall are consistent with this possibility. The radio-flux data are combined with an estimate of the optical synchrotron flux, and a theoretical power spectrum is computed from the synchrotron theory. A high-frequency cutoff between 2×10^{14} and 2×10^{15} is derived. The total synchrotron energy radiated in 1.5×10^6 years is 9×10^{55} ergs if the observed power level was constant over this time interval. The average magnetic-field strength is estimated to be H $< 2 \times 10^{-6}$ gauss on the basis that the energy stored in the relativistic electron gas was not replenished in 1.5×10^6 years and is sufficient to produce 9×10^{55} ergs of synchrotron radiation. This energy may have been put into the electrons at the time of the explosion. The time for the high-energy optical electrons to lose half their initial energy is longer than 1.5×10^6 years for a field strength of 2×10^{-6} gauss. Furthermore, if H is this small, the kinetic energy of the moving gas is sufficient to have pulled the field out of the plane of M82 when the expulsion of the matter began. Following Woltjer, it is shown that a possible source of the excitation for the low-energy recombination optical spectrum is the synchrotron-radiation field, that extends to frequencies above the Lyman limit, but more accurate measurements of the Hα and the synchrotron flux are needed to establish this possibility. (auth)

28107 A DISCUSSION OF THE DISK COMPONENT OF THE GALACTIC RADIO RADIATION. R. W. Wilson (California Inst. of Tech., Pasadena). Astrophys. J., 137: 1038-48(May 15, 1963).

A survey of the galactic plane at 960 Mc is compared with the survey of Hill, Slee, and Mills at 85.5 Mc. The radiation is separated into thermal and non-thermal components, using a method similar to the one employed by Westerhout. The temperature spectral index of the non-thermal components is found to be about 2.4, which is smaller than the value of 2.7 used by Westerhout. Models of the spatial distribution of both components are computed, and the distribution of ionized hydrogen differs from that found by Westerhout in that ionized hydrogen is found inside the 3-kiloparsec arm. Using a cloud model, the mass of ionized hydrogen in the Galaxy is found to be about 4×10^7 M ⊙, or 2.5 per cent of the mass of neutral hydrogen found by Westerhout. (auth)

28108 THE STRUCTURE OF STARS OF VERY LOW MASS. Shiv S. Kumar (Goddard Space Flight Center, New York). Astrophys. J., 137: 1121-8(May 15, 1963).

Completely convective models were constructed for stars of masses 0.09, 0.08, 0.07, 0.06, 0.05, and 0.04 (solar units), taking into account the non-relativistic degeneracy of the stellar material. It is shown that there is a lower limit to the mass of a main-sequence star. The stars with mass less than this limit become completely degenerate stars or black dwarfs as a consequence of gravitational contraction, and, therefore, they never go through the normal stellar evolution. (auth)

28109 SOLAR MAGNETIC FIELDS AND THE GREAT FLARE OF JULY 16, 1959. Robert Howard (Carnegie Institution of Washington, D. C. and California Inst. of Tech., Pasadena) and A. Severny. Astrophys. J., 137: 1242-50(May 15, 1963).

Ten magnetic maps of the active region on several days at the time of the 3+ flare of July 16, 1959, were obtained. At some time during a 15-hour interval within which the flare occurred, the higher magnetic fields near and inside the sunspots decreased by nearly a factor of 3. The resulting loss of magnetic energy amounted to about 10^{32} ergs, which is the estimated energy emitted in the form of cosmic rays from flares. Magnetic observations made of the active region during the course of the flare could not have shown the changes in the stronger fields. (auth)

28110 HIGH-RESOLUTION STUDIES OF TEN SOLAR ACTIVE REGIONS AT WAVELENGTHS OF 3-21 CM. G. Swarup (Stanford Univ., Calif.); T. Kakinuma, A. E. Covington, Gladys A. Harvey, R. F. Mullaly, and J. Rome. Astrophys. J., 137: 1251-67(May 15, 1963).

Ten strong sources of the slowly varying component (S-component) of solar radio emission were studied using high-resolution interferometers operating at wavelengths of 3.2, 7.5, 9.1, 10.7, and 21.1 cm. All the ten radio sources were associated with sunspot groups having areas greater than about 500 millionths of the solar hemisphere. The observations were obtained with interferometers that provide fan- and pencil-shaped beams having widths of about 1–3 minutes of arc. The wavelength dependence of the S-component was studied. It appears that a strong source of the slowly varying component has a higher value of flux density near 10 cm than at 3 cm or 21 cm. The size has a value of about 2–3 minutes of arc at wavelengths of 3 and 10 cm and about 3–4 minutes of arc at 21 cm. The calculated values of heights show a large scatter but are of the order of 10,000–20,000 km at wavelengths of 3 and 10 cm, and about 40,000–90,000 km at 21 cm. As other eclipse and interferometric observations have shown, the radio emission is circularly polarized, with the degree of polarization being >30 per cent at 3 cm, ~10 per cent at 10 cm, and <2 per cent at 21 cm. At 10.7 cm, the brightness temperatures of the ten sources range from 1.6 to 3.8 × 10^6°K when it is assumed that the north-south widths of the sources are equal to the observed east-west widths. The brightness temperatures show good correlation with both sunspot areas and magnetic fields. The above results about the flux-density spectrum and degree of polarization are not consistent with simple magnetoionic theory, in which only the effect of electron-ion collisional absorption is considered. It was suggested that resonance absorption at harmonics of the gyromagnetic frequency should also be considered to explain the above results. The steadiness of the radio emission from a strong source over periods of days supports the hypothesis of the thermal origin. This implies that the electron temperature of the solar corona above a large sunspot group reaches values of greater than 4 × 10^6°K. However, the possibility that a part of the S-component arises non-thermally cannot be ruled out at present. (auth)

28111 TERMINATION OF SOLAR WIND AND SOLAR MAGNETIC FIELD. W. I. Axford (Defense Research Board, Ottawa); A. J. Dessler, and B.Gottlieb. Astrophys. J., 137: 1268-78(May 15, 1963).

The solar magnetic field is twisted into an Archimedes spiral by the outward-flowing solar wind; this spiral field must also, on the average, co-rotate with the sun, in order for the solar wind to move radially outward without cutting magnetic lines of force. The interaction between the solar wind and the galactic magnetic field and interstellar medium results in the formation of a shock wave at a heliocentric distance of the order of 50 Å. Beyond the shock, the energy of the solar wind is transferred to the interstellar neutral atomic hydrogen by charge-exchange. Instabilities at the boundary between the solar plasma and the galactic medium cause blobs of solar plasma to form that are disconnected from the solar magnetic field by Sweet's mechanism; oppositely directed lines of force are joined to make large semipermanent magnetic tongues. The solar-wind energy that is transferred to neutral hydrogen is transported out into the galaxy by radiation or thermal conduction. It is found that the solar magnetic field does not permit solar-wind velocities less than about 100 km/sec. (auth)

28112 IONIZATION EQUILIBRIUM EQUATION OF STATE. V. TWENTY-TWO ELEMENT MIXTURES AT STELLAR TEMPERATURES AND DENSITIES. Carl A. Rouse (Univ. of California, Livermore). Astrophys. J., 137: 1286-95(May 15, 1963).

The ionization equilibrium equation of state for a mixture of twenty-two elements was calculated for two groups of temperatures and densities. The first group, given in tabular form, is the profile of an adopted photospheric model. The second group, given in graphical form, is a published profile of the sun. In the first group, three different H-He ratios are assumed, namely, 12.5, 20, and 5. The two extreme ratios yield differences in the ratios of singly ionized to neutral metal atoms of about 20 per cent. In the second group of calculations, large variations in the mean molecular weight and $\gamma - 1$ occur in the envelope. The variations of $d\gamma/dr$ throughout the envelope and core give deeper insight into the problem of stellar stability. (auth)

28113 GEOMAGNETIC AND SOLAR DATA. J. Virginia Lincoln, ed. (National Bureau of Standards, Boulder, Colo.). J. Geophys. Res., 68: 3723-5(June 15, 1963).

Data on geomagnetic disturbances with relation to solar flare sudden commencements are given for 1962. (C.E.S.)

28114 OBSERVATIONS AT 610 MEGACYCLES/SEC OF THE RADIATION FROM JUPITER. D. Barber and G. L. Moule (Royal Radar Establishment, Ministry of Aviation, Great Malvern, Eng.). Nature, 198: 947-8 (June 8, 1963).

Data obtained during April 1962 are presented from measurements of non-thermal radiation from Jupiter. Observations of discrete radio sources at 610 mc (49 cm wave-length) were made using the Royal Radar Establishment interferometer. Each observation was made with the arials following the position of Jupiter to give an interference record lasting about three-quarters of an hour. Observations were made at various hour angles and, for observations away from transit, path lengths were equalized by means of additional cable to make sure that the chromatic coherence curve went through a maximum. A 20-min extract from a typical interference record is presented and discussed. (C.H.)

28115 ELECTRON TEMPERATURES IN THE IONOSPHERE. A. Dalgarno (Geophysics Corp. of America, Bedford, Mass.), M. B. McElroy, and R. J. Moffett. Planetary Space Sci., 11: 463-84(May 1963).

Detailed calculations are described of the rate of heating of the ambient electrons arising from solar ultraviolet radiation and it is shown that the resulting difference between the electron temperature and the gas temperature at noon in a quiet ionosphere may reach a maximum value

lying between 800 and 1500°K at an altitude near 200 km but that the difference vanishes below about 120 km and above about 400 km. This is in accord with the analysis of the observational data by Bauer and Bourdeau that can therefore be explained as due to the direct action of solar ultraviolet radiation and it is unnecessary to postulate the existence of electric fields. (auth)

28116 INTERPRETATION OF K_p INDEX AND M-REGION GEOMAGNETIC STORMS. A. J. Dessler and J. A. Fejer (Southwest Center for Advanced Studies, Dallas). Planetary Space Sci., 11: 505-11(May 1963).

It is argued that the traditional interpretation of the K_p index is no longer tenable. The K_p index, generally taken to be a measure of the strength of the solar-wind flux, may be more acceptably interpreted as a measure of the time rate of change of the sum of plasma plus magnetic pressure acting on the magnetosphere. The stability of the magnetospheric surface in the solar wind is demonstrated theoretically when reasonable assumptions are made for the plasma density just inside the magnetosphere. The magnetic irregularities that were observed outside the magnetosphere do not appear to be hydromagnetic waves, but most likely are quasi-static irregularities that are swept past the detectors by the solar-wind flow. As a corollary to this new interpretation of K_p it is proposed that M-region geomagnetic storms are due to sheets of turbulence or irregularities that are generated by the collision of a region of high solar-wind velocity with a low velocity region. (auth)

Cosmic Radiation

28117 (AWRE-E-12/63) ENERGY DISSIPATION BY ELECTRONS VERTICALLY INCIDENT ON THE EARTH'S ATMOSPHERE. W. T. Shelton (United Kingdom Atomic Energy Authority. Weapons Group. Atomic Weapons Research Establishment, Aldermaston, Berks, England). June 1963. 47p.

Tabulations and curves of the energy dissipated by fast electrons entering the earth's atmosphere from monoenergetic, plane perpendicular sources are given. Curves relating ionization rates, altitude, and source energy are included. (auth)

28118 (HW-SA-2870) COSMIC-RAY NEUTRON MEASUREMENTS. R. A. R. Kent (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). May 25, 1963. Contract AT(45-1)-1350. 11p.

A polyethylene double moderator neutron dosimeter-fluxmeter was used to measure the flux density, dose rate, and average energy of the neutrons produced by cosmic rays near sea level. An average energy of 0.90 Mev and an average attenuation length of 144 g/cm^2 were determined for the neutrons. Values of 5.8 mrem/yr and 0.017 neutron/cm^2 sec were obtained for the dose rate and flux density, respectively. (D.C.W.)

28119 (PAN-382/VI) EVIDENCE FOR THE EXISTENCE OF HIGH ENERGY PHOTON-INITIATED E.A.S. R. Firkowski, J. Gawin, R. Maze, and A. Zawadzki (Polish Academy of Sciences. Inst. of Nuclear Research, Warsaw). Dec. 1962. 47p.

The existence of extensive air showers (EAS) with an abnormally low number of penetrating particles is demonstrated by the detailed analysis of the results of 10^5 hodoscopic recordings obtained during a running time of 28 months. These EAS constitute electromagnetic cascades deriving from a high energy photon of $10^{15}-10^{16}$ ev. Their frequency is equal to $1 \pm 0.35\%$ in relation to the ordinary nuclear showers of equal size and is several times smaller if compared to showers of the same energy. On the basis of a sharp distinction between the two types of shower, there is reason to ascribe an extra-atmospheric source to these high-energy photons. 27 references. (auth)

28120 ON THE TEMPERATURE-EFFECT OF THE DAILY VARIATION OF COSMIC RAY MESON INTENSITY. R. P. Kane (Physical Research Lab., Ahmedabad, India). Indian J. Phys., 37: 151-72(Mar. 1963).

The effect of the daily variation of atmospheric temperature on the daily variation of cosmic meson intensity recorded at ground level is discussed. Estimates of possible magnitudes of temperature effect are critically examined and shown to be rather unsatisfactory. Using for the temperature coefficient an ad hoc value of 0.02%/°C of ground temperature, past results regarding long-term changes of the amplitudes and hours of maxima of the first and second harmonic of daily variation of cosmic meson intensity are re-examined. It is shown that the temperature correction causes appreciable changes. However, in view of the divergent estimates of the temperature effects obtained so far, it is emphasized that a rigorous attempt at accurate experimental determination of daily variation of upper atmospheric temperatures is urgently needed. (auth)

28121 LOW-ENERGY SOLAR COSMIC RAYS AND TYPE IV SOLAR RADIO OUTBURSTS. Kunitomo Sakurai (Kyoto Univ.). J. Geomagnet. Geoelec., 14: 144-50(1963). (In English)

The relation of low-energy solar cosmic ray events to the type IV solar radio outbursts is examined statistically, using the data obtained during the IGY (1957-1958) and the ICG (1959). The solar radio emission data include those at frequencies 167, 200, 500, 1000, 3000, and 9500 Mc. With respect to the sun-earth transit time of those cosmic rays, it is found that there are two types, viz., F type (Fast type) and S type (Slow type), their transit time being shorter in F type particles than in S type particles. These two types correspond to the different characteristics of type IV outbursts spectra. It is found that the intense emission in the centimeter-wave region of type IV outbursts is closely related to the generation of solar cosmic rays. The mechanisms of their acceleration in the solar atmosphere and their propagation in relation to type IV outbursts are also examined. (auth)

28122 SOME RELATIONS OF THE CHORUS ACTIVITY TO THE COSMIC NOISE ABSORPTION, AURORAL ACTIVITY, AND K-INDEX AT THE AURORAL ZONE. T. Ondoh (Kyoto Univ.). J. Geomagnet. Geoelec., 14: 172-4(1963). (In English)

The average diurnal-variations of geomagnetic and auroral activities are presented for every month from August, 1959 to March, 1960 using the ionospheric absorption of cosmic radio noise, the chorus indices, the auroral radar activity, and the K-indices. It is shown that the diurnal variation of the chorus correlates with that of cosmic noise absorption, but the chorus peak often delays about an hour after that of the cosmic noise absorption, and that the chorus variation negatively correlates with the variations of the auroral activity and the K-index. Thus the chorus correlates with the incoming relatively high-energy charged particles that cause cosmic noise absorption, but not with the incoming low-energy particles that produce geomagnetic disturbances. (C.E.S.)

28123 CHARGED-PARTICLE OBSERVATIONS IN THE EARTH'S OUTER MAGNETOSPHERE. L. A. Frank, J. A.

Van Allen, and E. Macagno (State Univ., Iowa City, Iowa). J. Geophys. Res., 68: 3543-54(June 15, 1963).

By means of Explorer 14 a comprehensive, homogeneous survey of the spatial distribution of charged particles associated with the geomagnetic field was made within the geocentric radial distance range 300 to 105,000 km and within the range of sun-earth-probe angle 58 to 150°. The distribution of electrons of $E \gtrsim 40$ kev in the outer magnetosphere is discussed. The new measurements in conjunction with the earlier similar ones from Explorer 12 show that the interior part of the magnetosphere terminates at 10 earth radii on the noon meridian and at 7 earth radii on the midnight meridian; that the magnetospheric boundary in the geomagnetic equatorial plane flares away from its semicircular form on the sunward side at a sun-earth-probe angle of about 70° and has a generally ogival shape to at least a radial distance of 16.5 earth radii; and that there is a relative void of energetic electrons on the night side of the earth in a region bounded on its inward side by an approximate semicircle of 7 earth radii and on its outward side by the ogival skirt of high intensities. It is shown that these results provide a measure of coherence to a diverse body of previously discordant observations and provide a new foundation for physical models of the magnetosphere and of the interaction of the solar wind with the geomagnetic field. (auth)

28124 THE PREDICTION OF SOLAR ACTIVITY. John H. Reid (Dublin Inst. for Advanced Studies). New Scientist, 18: 540-2(June 6, 1963).

The general behavior of sun spots and flares are discussed. The high-energy particles from flares necessitates a method for long-range predictions of flare activity. At present, a warning of only 10 to 15 minutes before a flare can be obtained. (D.L.C.)

28125 CONNEXIONS BETWEEN GEOMAGNETIC AND AURORAL ACTIVITY AND TRAPPED IONS. J. H. Piddington (CSIRO, Sydney). Planetary Space Sci., 11: 451-62 (May 1963).

Primary ions (energy 0.1–10 kev) and secondary ions (energy 25–500 kev) are separated on the basis of: energy spectrum in interplanetary space, energy acquired while entering the geomagnetic field, storage of primary ions in a third trapping zone, acceleration of a few primary ions and transfer to the second zone, precipitation mechanisms, and auroral and other atmospheric effects. A mechanism is suggested for introducing primary ions in the geomagnetic cavity and storing them in a zone between geocentric distances ~7–12 Earth radii. Many will be lost directly into the ionosphere above the poles, others will be lost after an hour or so at high latitudes near local midnight. The flux in the third zone might reach 10^{10} electrons cm^{-2} sec^{-1}, mostly of energy $\gtrsim$100 ev. Magnetospheric motions caused by the solar ion stream give rise to electric fields that may accelerate some primary ions and store them in a second trapping zone. The same dynamo motions, through hydromagnetic instability, give rise to small-scale vortex cells mainly in and near the auroral zones. The instability cells have small dimensions across the field but are very elongated. They rotate about their axes and develop helical twists; being in a region of shear they are torn apart so that strands of magnetic force become threaded transversely across the main field. These narrow strands tend to short circuit the electric potential fields, causing currents to discharge into the auroral zones. This electrical mechanism may explain the dumping, sometimes accompanied by acceleration, of primary ions. The same magnetic field distortion may also explain the dumping of higher energy ions by changing their magnetic moments. The two dumping mechanisms are thus closely connected but may operate independently. (auth)

28126 ON S. H. DOLE'S PAPER "THE GRAVITATIONAL CONCENTRATION OF PARTICLES IN SPACE NEAR THE EARTH". R. B. Southworth (Smithsonian Astrophysical Observatory and Harvard Coll. Observatory, Cambridge, Mass.). Planetary Space Sci., 11: 499-503 (May 1963).

Dole considered the density distribution near the Earth of particles that were in circular orbits in the ecliptic plane and were strongly perturbed by the Earth. Contrary to his conclusions, the space density of such particles will not be increased by more than a factor of twelve, and will be proportional to the –0.5 power of the distance from the Earth. The process is sensitive to the initial particle orbits, and is applicable to one-half per cent of photographic meteors, and to less than one-half per cent of all smaller particles such as can be seen in the zodiacal light. (auth)

28127 THE EARTH'S RADIATION BELTS AT ALTITUDES OF 180-250 km. S. N. Vernov, I. A. Savenko, P. I. Shavrin, V. E. Nesterov, and N. F. Pisarenko. Planetary Space Sci., 11: 567-74(May 1963). Translated by J. Cornish from Iskusstv. Sputniki Zemli No. 13, p.67(1962).

The third Soviet satellite in an orbit with perigee 187 km, apogee 265 km, and inclination to the equatorial plane of 65°, made it possible to trace the variation in the intensity and geographical position of the radiation belts on transition to lower altitudes. The satellite's passage through sections of the radiation belts was accompanied by a sharp rise in the counting rate. Points were plotted on a map, at which the counting rate greatly exceeded the cosmic background. For comparison, points obtained from the second Soviet satellite were also plotted. Conjugate points were found for some points in the Northern and Southern Hemispheres. The unambiguous association between the zones of increased intensity in the Northern and Southern Hemispheres was one of the proofs that these zones belong to the outer radiation belt. (C.E.S.)

28128 PROGRESS IN ELEMENTARY PARTICLE AND COSMIC RAY PHYSICS. VOLUME VI. J. G. Wilson and S. A. Wouthuysen, eds. From The Series in Physics. Progr. Elem. Particle Cosmic Ray Phys., 6: 1-344(1962). New York, John Wiley & Sons, Inc., 1962. $13.75.

The geophysical and cosmological features of cosmic radiation are presented. The material is divided into three chapters on cosmic-ray produced isotopes and their geophysical applications, time variations of cosmic rays during sunspot cycles, and geomagnetically trapped radiation. Separate abstracts are prepared for each chapter. (C.E.S.)

28129 COSMIC RAY PRODUCED ISOTOPES AND THEIR APPLICATION TO PROBLEMS IN GEOPHYSICS. D. Lal (Tata Inst. of Fundamental Research, Bombay) and B. Peters. Progr. Elem. Particle Cosmic Ray Phys., 6: 1-74(1962).

The changes in chemical and isotopic composition on the earth resulting from cosmic-ray induced nuclear transformations, the movement of these isotopes after formation, and their concentration in the various natural reservoirs are reviewed. (C.E.S.)

28130 TIME VARIATIONS OF LOW RIGIDITY COSMIC RAYS DURING THE RECENT SUNSPOT CYCLE. W. R. Webber (Imperial Coll. of Science and Tech., London). Progr. Elem. Particle Cosmic Ray Phys., 6: 75-243(1962).

Treatment of the real geomagnetic field as it affects incoming cosmic ray primaries and particularly as it deter-

mines the effective cut-off rigidity is summarized. Data on low rigidity primaries of solar origin, the modulation of galactic radiation, and the relation between long term variation and Forbush-events are considered for the rigidity properties of the actual geomagnetic field. (C.E.S.)

28131 GEOMAGNETICALLY TRAPPED RADIATION. S. F. Singer and A. M. Lenchek (Univ. of Maryland, College Park). Progr. Elem. Particle Cosmic Ray Phys., 6: 245-335(1962).

The history of the identification and study of the radiation belts is reviewed. The motion of electrons is examined in static and perturbed geomagnetic fields and in relation to the high atmosphere. A quantitative estimate of the albedo neutron source is developed. The lifetime and injection mechanisms for trapped protons are also considered. (C.E.S.)

28132 PRODUCTION OF CARBON 14 BY COSMIC-RAY NEUTRONS. R. E. Lingenfelter (Univ. of California, Los Angeles). Rev. Geophys., 1: 35-55(Feb. 1963).

The rate of production of carbon-14 by cosmic neutrons is calculated by multigroup diffusion theory as a function of altitude, latitude, and time, and it is normalized to absolute cosmic neutron flux measurements. The global average production rate over the last ten solar cycles is found to be 2.50 ± 0.50 carbon-14 atoms per square centimeter per second. This value is compared with recent estimates of the decay rate of 1.8 ± 0.2 and 1.9 ± 0.2, and some of the possible implications are discussed. (auth)

28133 ANGULAR DISTRIBUTION OF COSMIC RAY MUONS UNDER THICK FILTERS. A. A. Petrukhin and I. L. Rozental (Moscow Inst. of Engineering Physics). Zh. Eksperim. i Teor. Fiz., 44: 1618-21(May 1963). (In Russian)

The angular distribution of cosmic muons under thick layers of soil is calculated. The calculated and experimental data on the angular distributions at large depths are compared. The results of the experiments and calculations are in agreement. This result seems to indicate that the cross sections for elementary interaction processes involving fast muons (energy from 10^{12} to 10^{13} ev) are satisfactorily described by theory. (auth)

Criticality Studies

28134 EXPERIMENTAL BUCKLINGS AND VOID EFFECTS IN HEAVY WATER LATTICES OF NATURAL URANIUM OXIDE ROD CLUSTERS. W. E. Graves, H. R. Fike, and G. F. O'Neill (E. I. du Pont de Nemours and Co., Aiken, S. C.). Nucl. Sci. Eng., 16: 186-95(June 1963).

The material bucklings of twenty-five D_2O moderated lattices of natural UO_2 rod clusters were measured in the Process Development Pile (PDP). The measurements were made in one-region loadings, and should therefore be subject to little systematic error. A number of the lattices employed voided housing tubes around the fuel assemblies. Values of migration areas inferred from measurements of positive periods are also presented. An evaluation of the errors in the buckling measurements indicated that the bucklings should be accurate to about 1%. The migration areas are compared with theoretical values obtained from the Benoist theory, and the agreement is shown to be good. (auth)

28135 CADMIUM RATIOS OF U^{235} FISSION IN SLIGHTLY ENRICHED URANIUM, LIGHT WATER MODERATED LATTICES. S. Tassan (Brookhaven National Lab., Upton, N. Y.). Nucl. Sci. Eng., 16: 248-9(June 1963).

The cadmium ratios for U^{235} fission (δ_{25}) were remeasured for some water-moderated lattices, using enriched U–Al foils. The δ_{25} results are tabulated for rod diameters of 0.60 and 0.25 in. and water/uranium ratios of 1 to 4. The corresponding conversion ratios are also tabulated and found to be in good agreement with these obtained from the cadmium ratios in gold. (D.L.C.)

Elementary Particles and Radiations

28136 (BNL-6363) THEORY OF FINAL STATE INTERACTIONS. Michael Nauenberg (Brookhaven National Lab., Upton, N. Y.). Aug. 20, 1962. Contract [AT(30-2)-Gen-16]. 10p.

Using requirements of analyticity and the unitarity of the S-matrix, the dependence of a transition amplitude on the invariant mass of two particles in the final state, when these are strongly coupled to other two-particle channels, is obtained. As an example, the production of a Σ-π state near the Y_0^* resonance is considered assuming it is coupled to a $\bar{K}$-N state in an $s_{1/2}$ state. (auth)

28137 (BNL-6364) INTERPRETATION OF THE SCATTERING FROM A LIQUID-LIKE BINARY. D. T. Keating (Brookhaven National Lab., Upton, N. Y.). [1962]. Contract [AT(30-2)-Gen-16]. 12p.

The three radial densities needed to characterize the scattering from the most general liquid-like binary are demonstrated. It is noted that if the density of atoms is the same around both components, then only two functions are needed to describe the scattering. The densities and functions can be obtained by the Fourier inversion of a weighted combination of three or two diffraction patterns (for the two cases, respectively) differing by the alteration of the scattering of the components. The necessary combinations of diffraction patterns are given. (auth)

28138 (ISS-63/28) RELAZIONI PRESENTATE AL CONGRESSINO DEI LABORATORI NAZIONALI DI FRASCATI (6-8 MAGGIO 1963). (Papers Presented at the Congress of the National Laboratories in Frascati (May 6-8, 1963)). Italy. Istituto Superiore di Sanità, Rome). 42p.

The summaries of the papers presented by the Physics Laboratory of the Istituto Superiore de Sanita at the High Energy Physics Congress held in Frascati are compiled. The papers deal with the following subjects: π^- absorption in complex nuclei, preliminary study of (e,e'p) experiment to be carried out at Frascati, preliminary study of (e,e'γ) experiment to be carried out at Frascati, analysis of track chamber pictures, and double π meson photoproduction on protons. A separate abstract for the first paper has been prepared. (J.S.R.)

28139 (ISS-63/28(p.1-11)) ASSORBIMENTO DI MESONI π^- IN NUCLEI COMPLESSI. (Absorption of π^- Mesons in Complex Nuclei). G. Campos Venuti, G. Fronterotta, and G. Matthiae (Italy. Istituto Superiore di Sanità, Rome).

The deexcitation processes in a nucleus as a result of the absorption at rest of a π^- meson were studied by measurement of the energy of the neutrons emitted from 1 to 50 Mev. The experimental set-up for measurement of the neutrons emitted is described. Targets of Cu, Sn, and Pb were used. The results are given as a function of number of neutrons emitted per pion absorbed and per 1-Mev energy interval. The three spectra show quite similar characteristics. The mean number of neutrons emitted per pion

absorbed is 6.9 ± 0.4 for Cu, 8.0 ± 0.5 for Sn, and 8.9 ± 0.5 for Pb. The results are in satisfactory agreement with Monte Carlo calculations. (J.S.R.)

28140 (JINR-D-1236) CONTRIBUTION OF ^3P AND ^3F WAVES TO MESON PRODUCTION IN pp-COLLISIONS AT 660 Mev. I. Bystritsky and R. Zul'karneev (Joint Inst. for Nuclear Research, Dubna, U.S.S.R. Lab. of Nuclear Problems). 1963. 6p.

An analysis of elastic p-p scattering was recently made with account of the imaginary parts of the phase shifts of ^3F states. Four solutions were found in the range $\overline{\chi}^2 < \chi^2 < 2\overline{\chi}^2$, some of them leading to pion production mainly from the D,^3F states. It is concluded that the non-resonance transitions in pion production are also important in p-p collisions at 660 Mev. It is stressed that with the increasing energy the role of the one pion exchange may be dominant in elastic p-p scattering with $L \geq 2$, as well. As a whole, the investigation is devoted to the clearing up of the present situation in the phase shift analysis of the data on elastic pp-scattering at 660 Mev. (auth)

28141 (JINR-E-1252) RELATIVISTIC CAUSALITY IN THE QUANTUM MECHANICS OF A SCALAR PARTICLE. M. I. Shirokov (Joint Inst. for Nuclear Research, Dubna, U.S.S.R. Lab. of Theoretical Physics). 1963. 13p.

The relativistic quantal problem of the packet spreading of a scalar particle is considered, and a hypothetical experiment on the transfer of a signal at superluminary velocity is discussed. A theory in which the well-known causality condition is fulfilled (e.g., the vanishing of the commutator of the field quantities at the corresponding points) is used. The packet localization is carried out in terms of the Newton-Wigner coordinate for a scalar particle. A direct mathematical cause of this phenomenon is the non-vanishing of the well-known propagation function outside the light cone. It is indicated that the uncertainty relation cannot smear out this effect. An analogous situation occurs with the Dirac particle. Attempts to avoid or overcome the causality trouble without radically changing the quantal postulates are discussed. (auth)

28142 (JINR-E-1262) ALGEBRAIC EQUATIONS FOR MESON-NUCLEON SCATTERING IN THE APPROXIMATION OF THE TWO-PARTICLE UNITARITY. I. P. Nedialkov (Joint Inst. for Nuclear Research, Dubna, U.S.S.R. Lab. of Theoretical Physics). 1960. 11p.

Instead of the well-known integral equations, following from the Mandelstam representation, a system of nonlinear algebraic equations is derived. It is an essential feature that algebraic systems are derivable for both analytical scattering amplitudes. (auth)

28143 (JINR-P-1241) VZAIMODEISTVUYUSHIE PODYA SO SPINOM 1 I SVOISTVA SIMMETRII. (Interacting Fields of Spin 1 and Symmetry Properties). V. I. Ogievetskii and I. V. Polubarinov (Joint Inst. for Nuclear Research, Dubna, U.S.S.R. Lab. of Theoretical Physics). 1963. 30p.

Theories in which each interacting field possesses a definite spin (theories of class A) are considered. It is shown that the conservation laws of baryon charge, strangeness, isotopic spin and electric charge are closely connected with the space-time property of the vector spin 1 fields–property to possess a definite spin. So, the existence of truly neutral fields of spin 1 (e.g. photon or ω-meson) generates invariances corresponding to the conservation of additive quantum numbers (e.g. electric charge, baryon charge or strangeness). The existence of charged spin 1 fields (e.g. ρ-meson) leads to invariances of the isotopic type, etc. The proof proceeds by analysing the most general local relativistically invariant Lagrangian for the arbitrary system of any number of interacting fields of spins 1, $\frac{1}{2}$ and 0. The only restriction accepted is the dimensionlessness of coupling constants. In the theories of the class A each interacting massive vector field must satisfy the Lorentz condition that singles out spin 1 and is closely connected with the Lorentz inhomogeneous group. Instead of this an arbitrariness of the 4-divergences is required for zero mass vector fields. As a consequence, matrices constructed out of the coupling constants must constitute representations of the Lie algebras manifesting the above-mentioned symmetry properties. The coupling constants for the vector field self-interaction are proved to be structure constants of the algebra. (auth)

28144 (JINR-P-1245) POLYUSNAYA TEORIYA ROZHDENIYA Λ GIPERONOV B πN p-VZAIMODEISTVIYAKH PRI BOLSHIKH ENERGIYAKH. (Pole Theory of Λ-Hyperon Production in π^--p Interactions at High Energies). V. S. Barashenkov, D. I. Blokhintsev, E. K. Mikhul, I. Patera, and G. L. Semashco (Joint Inst. for Nuclear Research, Dubna, U.S.S.R. Lab. of Theoretical Physics). 1963. 17p.

The cross section and the momentum spectrum of Λ hyperons produced in the interaction of 7-Bev pions with protons were calculated in the one-meson pole approximation. The results of the calculations agree with the experimental data if the resonance K-π interaction experimentally observed is taken into account. The momentum spectrum of Λ hyperons has a characteristic two-humped shape. In the resonance approximation the inelastic π^--p interactions with the many-meson intermediate states were treated. It is shown that within the accuracy of the presently available experimental data the contribution from such interactions may be neglected. (auth)

28145 (JINR-P-1246) K VYCHISLENIYU TRAEKTORII REDZHE ρ-MEZONA. (On a Calculation of the ρ-Trajectory). J. Wolf (Joint Inst. for Nuclear Research, Dubna, U.S.S.R. Lab. of Theoretical Physics). 1963. 4p.

The calculation of the ρ-trajectory is considered in more detail. For given experimental values of the trajectory at $t = 0$, the value of the trajectory at threshold is varied. The right half-width of the ρ-resonance is obtained if this value at threshold is greater than one half. Comment is made on the behavior at the first threshold and on a possible oscillatory behavior at higher thresholds. (auth)

28146 (JINR-P-1253) KRAZIOPTICHESKII POTENTSIAD V MODELL KVANTOVOI TEORII POLYA. (Quasi-optical Potential in Model of Quantum Field Theory). Nguyen-Van-Hieu and R. N. Faustov (Joint Inst. for Nuclear Research, Dubna, U.S.S.R. Lab. of Theoretical Physics). 1963. 11p.

The construction of an energy-dependent potential by the perturbation theory was considered in the model of quantum field theory with scalar particles. The method of the two-time Green functions and that of the scattering amplitude on the mass shell were used. The calculated corrections to the Coulomb energy levels coincide for both methods. The second one, however, is more effective due to the locality and analyticity of the potential. (auth)

28147 (JINR-P-1266) FENOMENOLOGICHESKII ANALIZ pp- VZAIMODEISTVIYA PRI 657 Mev. I. (Phenomenological Analysis of p-p Interaction at 657 Mev. [Part] I.). L. S. Azhgiri, N. P. Klepikov, Yu. P. Kumekin, M. G. Mescheryakov, S. B. Nurushev, and G. D. Stoletov [Joint Inst. for Nuclear Research, Dubna, U.S.S.R. Lab. of Nuclear Problems]. 1963. 14p.

A phase shift analysis was made of the available data on the p-p interaction near 660 Mev. These data include the differential cross sections for elastic scattering, polarization, depolarization, triple scattering parameters R and A, spin correlation parameters C_{KP} and C_{NN_t} total p-p interaction cross section and the total cross sections for the reactions $pp \rightarrow \pi^+pn$, $pp \rightarrow \pi^+d$, $pp \rightarrow \pi^0pp$. The statistically best set of the real parts of the phase shifts was: $\delta(^1S_0) = 31.5 \pm 4.0$; $\delta(^3P_0) = -52 \pm 10$; $\delta(^3P_1 = 36.9 \pm 3.7$; $\delta(^3P_2) = 18.8 \pm 1.2$; $\delta(^1D_2) = 11.7 \pm 2.2$; $\delta(^3F_2) = 4.2 \pm 1.8$; $\delta(^3F_3) = -0.2 \pm 1.4$; $\delta(^3F_4) = 1.6 \pm 0.7$ and $\delta(^1G_4) = 7.9 \pm 0.7$ (in degrees). The absorption coefficients are $r(^3P_{0,1,2}) = 0.954 \pm 0.019$; $r(^1D_2) = 0.668 \pm 0.038$ and $r(^3F_{2,3}) = 0.781 \pm 0.020$. The real parts of the phase shifts found are in agreement with the YLAM solution, if the latter is continued smoothly and with another solution. It was found that, in accordance with the peripheral model of inelastic processes, the ^3F states contribute considerably to pion production. 41 references. (auth)

28148 (JINR-P-1287) O NEKOTORYKH ZAKONOMERNOSTYAKH V SISTEME STRANNYKH REZONAISOV. (On Some Regularities in a System of Strange Resonances). V. S. Barashenkov and V. M. Maltsev (Joint Inst. for Nuclear Research, Dubna, U.S.S.R. Lab. of Theoretical Physics). 1963. 3p.

A systematization of pion-hyperon states that permits determination of the quantum numbers of hyperon resonances is given. (D.C.W.)

28149 (LNF-63/21) A UNITARY SYMMETRY MODEL FOR PHOTOPRODUCTION. Note No. 192. A. Fujii and L. Holloway (Italy. Comitato Nazionale per l'Energia Nucleare. Laboratori Nazionali, Frascati). Apr. 12, 1963. 8p.

The photoproduction of pseudoscalar mesons is considered from the viewpoint of unitary symmetry. Properties of Lie groups are reviewed; irreducible representations of the 8 × 8 product space of a baryon and a meson are constructed (basis vectors are given); and relations between the various photoproduction amplitudes are formed. Expressions for the cross sections are developed and examined, and relations for the photoproduction amplitudes in the Sakata Model are found. (D.C.W.)

28150 (LNF-63/31) METHODS FOR DETERMINING THE SPIN OF Ξ. Note No. 197. M. Ademollo and R. Gatto (Italy. Comitato Nazionale per l'Energia Nucleare. Laboratori Nazionali, Frascati). May 5, 1963. 17p.

Tests of Ξ spin are proposed that consist of measuring and comparing among each other some averages over the angular distribution of the Λ resulting from Ξ decay. The averages can directly be constructed out of experimental data, and a discussion on the statistical errors arising from application of the tests to a finite sample of Ξ decays is given. General statements arising from a quadratic relation among the coefficients of the production density matrix valid for production on unpolarized nucleons are also given. The question of the Ξ parity is briefly considered assuming only s- and p-waves at production. (auth)

28151 (NEVIS-111) ON THE INTERACTION OF HIGH-ENERGY NEUTRINOS WITH MATTER. Nariman B. Mistry (Columbia. Univ., Irvington-on-Hudson, N. Y. Nevis Labs.). June 1963. Contract AT(30-1)-1932. 124p. (R-362; CU-217)

High energy neutrinos, created primarily in the decay in flight of energetic pions produced at the Brookhaven AGS, were observed to interact in a ten-ton aluminum spark chamber. Evidence is presented that the interactions observed are in fact produced by neutrinos (that is, by neutral, weakly interacting particles that are the decay products of pions and kaons) and not by neutrons, photons or any other known particles; neither are they "spurious events" simulated by cosmic rays. Events are observed in which a single long track is visible. These tracks are presumed to result from "elastic" collisions of neutrinos with nuclei where secondary muons of momentum greater than 300 Mev/c are produced. Recoil nuclear fragments are not observed in most cases. The rate of such events is compared with the rates predicted by current weak-interaction theory under various assumptions about the "form-factors"; a comparison is also made with rates predicted under the assumption that an "intermediate boson" mediates the weak interactions. The results indicate that there is no serious departure from simple V,A-theory at the average momentum transfer of 350 Mev/c. Finally, a few of the more complex events are discussed. These are consistent with the actual creation and subsequent decay of an intermediate boson, although due to the inherent poor spatial resolution of the spark chamber and the lack of specific kinematics for individual events, no definite result can be demonstrated for the existence of the boson. 37 references. (auth)

28152 (NEVIS-113) EXPERIMENTAL PROOF OF THE EXISTENCE OF TWO NEUTRINOS (thesis). Konstantin Goulianos (Columbia Univ., Irvington-on-Hudson, N. Y. Nevis Labs.). June 1963. Contract AT(30-1)-1932. 100p.

The experiment utilized high energy neutrinos (antineutrinos) produced primarily as the result of the decay in flight of pions, $\pi \rightarrow \mu + \nu(\bar{\nu})$. The interaction of these neutrinos with matter was studied in a ten-ton aluminum spark chamber. It is demonstrated that the neutrinos used produce muons, but do not produce electrons. This result is incompatible with electron-muon universality or with the conserved vector current (CVC) theory of β decay, unless ν_μ, the neutrino coupled to the muon and produced in pion decay, is different than ν_e, the neutrino coupled to the electron and produced in nuclear β decay. Insofar as the results of all relevant low energy experiments are in agreement with (e-μ)-universality and the CVC theory, the only plausible explanation for the absence of the electrons is that $\nu_\mu \neq \nu_e$, i.e., that there exist at least two types of neutrinos. 51 references. (auth)

28153 (NP-12904) BOSON EIGENSTATES IN GENERALIZED FIELD THEORY. H. C. Corben (Space Technology Labs., Inc., Los Angeles). [1963]. 8p.

Eigenstates arising from the generalized Dirac and Kemmer equations are examined for connections with the particles and resonances of spin 0, 1, 2 observed in nature. The Dirac equation is shown to lead to the correct spins, masses, and conjugate doublet structure for K and K* mesons. The spin of the ζ particle is predicted to be 1, while that of the f^0 is predicted to be 2. Eigenstates and possible identifications for the Kemmer equation are also listed. (D.C.W.)

28154 (NYO-10264) ϕ-MESON AND UNITARY SYMMETRY MODEL. S. Okubo (Rochester, N. Y. Univ.). May 8, 1963. Contract AT(30-1)-875. 13p.

The properties of the ϕ meson are investigated within the framework of the unitary symmetry model. Mass relations for the vector octet (ρ, ω, $K^*\bar{K}^*$) and the ϕ boson are derived by dealing with a nonet composed of the octet and the ϕ boson. Relations for the eigen-masses of $\tilde{\omega}$ and $\tilde{\phi}$ are also obtained, along with relations for radiative decay processes. (D.C.W.)

28155 (ORNL-3429) A FORTRAN PROGRAM FOR CALCULATING THE SCATTERING OF NUCLEONS FROM A NONLOCAL OPTICAL POTENTIAL. F. G. Perey (Oak Ridge National Lab., Tenn.). July 11, 1963. Contract W-7405-eng-26. 72p.

The listing of a FORTRAN program for calculating the scattering of nucleons from a nonlocal optical potential is given. The mathematical formulation of the problem is presented, together with the numerical methods used in the code. The input to the program is explained, and a brief functional description of each subroutine of the code is included. (auth)

28156 (UCRL-10563) π^+-p SCATTERING AT 600 Mev (thesis). Peter Cyrenius Adelbert Newcomb (California. Univ., Berkeley. Lawrence Radiation Lab.). Jan. 7, 1963. Contract W-7405-eng-48. 80p.

The Berkeley 15-inch hydrogen bubble chamber was used at the Bevatron to investigate π^+-p interactions at 600 Mev. Seventeen hundred and thirty-eight good events were found; 71.9 ± 0.8% of these were elastic. The inelastic interactions were almost entirely single pion production. The elastic angular distribution was fitted by a fourth order polynomial in cos $\theta_{c.m.}$. This implies that states with an orbital angular momentum of at least 2 $\hbar$ were present. It was also shown that the upper bound of the total angular momentum was at least (5/2) $\hbar$, where $\hbar$ is Plank's constant divided by 2 π. For the single pion production, the ratio of the number of interactions of the type $\pi^+ + p \rightarrow \pi^+ + p + \pi^0$ to those of the type $\pi^+ + p \rightarrow \pi^+ + n + \pi^+$ was found to be 5.5 ± 0.8. This result is in good qualitative agreement with the value 6.5 predicted by Sternheimer and Lindenbaum. The pion momentum spectra for the reaction $\pi^+ + p \rightarrow \pi^+ + p + \pi^0$ do not show the dip predicted by Bergia, Bonsignori, and Stanghellini. A peak was found in the $Q(\pi^+\pi^0)$ distribution; however, it is thought that this peak is more likely to be an effect of the $(^3/_2, ^3/_2)$ pion-nucleon isobar than that of a π-π resonance. Angular distributions are also given for the inelastic events. 21 references. (auth)

28157 (UCRL-10637) POLARIZATION AND DIFFERENTIAL CROSS SECTIONS IN PROTON-PROTON AND PROTON-NUCLEUS SCATTERINGS AT 730 Mev (thesis). Paul G. McManigal (California. Univ., Berkeley. Lawrence Radiation Lab.). Mar. 15, 1963. Contract W-7405-eng-48. 68p.

The polarization and angular distribution of protons scattered from protons, helium, beryllium, carbon, aluminum, calcium, iron, and tantalum were measured as functions of angle at 730 Mev. A variation of the usual double-elastic-scattering method was used, in that the sense of the first scattering angle was reversed in finding asymmetries rather than the second angle. Elasticity of scattering was favored by a 102-deg magnetic spectrometer that clearly separated particles losing more than 15 Mev in scattering. The polarization in proton-proton scattering reaches a maximum of more than 60%, while polarization obtained from scattering from other nuclei remains lower. The polarized angular distribution indicates that the $^3F_4$ state or higher waves of odd parity must play a significant role in proton-proton scattering. The proton-nucleus scattering was fitted by an optical model. 34 references. (auth)

28158 (UCRL-10720) THE REACTION $\pi^-p \rightarrow \pi^-\pi^+n$ BELOW 800 Mev. (thesis). Janos Zirz (California. Univ., Berkeley. Lawrence Radiation Lab.). Mar. 12, 1963. Contract W-7405-eng-48. 81p.

The reaction $\pi^- + p \rightarrow \pi^- + \pi^+ + n$ is studied in the Lawrence Radiation Laboratory 72-inch hydrogen bubble chamber. Events are located by scanning the pictures for π^+ tracks. Cross sections, Dalitz plots, angular distributions, and $\pi^+\pi^-$ and π^+n mass spectra are given at beam energies of 360, 430, 460, 480, 555, 605, 673, and 780 Mev. No clear evidence is found for $\pi^+\pi^-$ resonances between threshold and $M_{\pi\pi}$ = 680 Mev. However, there is a strong preference for high $\pi^+\pi^-$ effective masses, especially at the lowest beam energies. Arguments are given to ascribe this anomaly to the I = 0 state of the π-π system. Production of the N^*_{δ} (1238) isobar is observed in its negative charge state. 33 references. (auth)

28159 (UCRL-10723) PROPERTIES OF THE ω MESON FROM $K^- + p \rightarrow \Lambda + \omega$. Joseph J. Murray, Jr., Massimiliano Ferro-Luzzi, Darrell O. Huwe, Janice B. Shafer, Frank T. Solmitz, and M. Lynn Stevenson (California. Univ., Berkeley. Lawrence Radiation Lab.). Mar. 14, 1963. Contract W-7405-eng-48. 21p.

Studies of the reaction $K^- + p \rightarrow \Lambda + \omega$ at 1.51 Bev/c are reported. On the basis of 650 $\omega \rightarrow 3\pi$ decays and 40 $\omega \rightarrow$ neutral decays, the branching ratio of neutral to charged decay is found to be 0.11 ± 0.03. The width of the $\omega \rightarrow 3\pi$ decay is determined to be 4 ± 4 Mev by the use of an extrapolation method. Evidence for the rare two-pion decay mode is presented. The production angular distribution for the ω peaks slightly forward, as does that of the ρ meson. Cross sections for ω production and subsequent decay into its charged and neutral modes are 800 ± 40 and 83 ± 22 μb, respectively. (auth)

28160 (UCRL-10842) WHAT IS THE NUCLEON? Geoffrey F. Chew (California. Univ., Berkeley. Lawrence Radiation Lab. and Cambridge Univ., England). June 24, 1963. Contract W-7405-eng-48. 18p.

The concepts of "elementary" and "composite" particles are reviewed, the status of the nucleon receiving special attention. It is concluded that the nucleon is probably not more fundamental than other nuclei but that sound practical reasons nonetheless exist for giving this particle concentrated experimental and theoretical study. The notion of nucleon "structure" is examined, the dubious status of the subatomic space-time continuum being emphasized; and it is argued that the most promising medium in which to seek an understanding of the origin and properties of a strongly interacting particle such as the nucleon is the momentum-energy continuum. Attempts to formulate fundamental laws in this framework are surveyed. (auth)

28161 EQUATIONS FOR THE REDUCED DISTRIBUTION FUNCTIONS OF A MIXTURE OF PARTICLES. E. Kaczmarek (Inst. of Basic Technical Problems, Polish Academy of Sciences, Warsaw). Acta Phys. Polon., 23: 439-42(Apr. 1963). (In English)

Equations for the reduced distribution functions of a mixture of particles of different kinds are derived on the basis of the Bogolyubov method. Two cases of equations were considered: the equation for reduced distribution function of one kind of particles and the equation for reduced distribution function of a mixture of two kinds of particles. (auth)

28162 FOUR-PION WAVE FUNCTIONS. M. Grynberg and Z. Koba (Inst. of Nuclear Research, Warsaw). Acta Phys. Polon., 23: 501-26(Apr. 1963). (In English)

Following the same procedure as in the case of three pions, a complete set of orthonormal wave functions for four free pions were derived. These wave functions describe systems of pions, which satisfy the Bose statistics and possess definite values of the total energy, the total

angular momentum, and the parity in the center of mass system in the non-relativistic approximation, as well as a definite total isospin and a definite charge parity when the system is neutral. The procedure of construction of this set of wave functions is described in detail and their explicit expressions are given up to $\Lambda = 3$, and the number of these eigenstates are listed up to $\Lambda = 5$, where Λ is the effective angular momentum. (auth)

28163 MUONIUM: A NEW ATOM. Vernon Hughes (Yale Univ., New Haven). Am. Scientist, 51: 110-13(Mar. 1963).

With the principal aim of studying the μ meson more carefully and, in particular, the relation of the μ meson and the electron, the parity nonconservation phenomena were used to discover the muonium atom, consisting of a μ meson and an electron, and to measure with high precision the magnetic interaction between the μ meson and the electron. The results provided further definite proof that the μ meson differs from the electron only in the value of its mass. The muonium atom is very similar to the hydrogen atom. The gross energy level scheme of muonium is identical with that of hydrogen with the exception of a different reduced mass correction, and hence the optical spectrum of muonium should be nearly the same as that of hydrogen. Just as for hydrogen, muonium has a hyperfine structure to the gross energy level scheme which arises from the magnetic interaction between the spin, or intrinsic, magnetic moment of the electron and the spin magnetic moment of the μ meson. The hyperfine structure of the ground (n = 1) state of muonium is predicted to be 4463 Mc/sec as compared to 1420 Mc/sec for hydrogen, where the difference arises primarily from the different values for the spin magnetic moments of the proton and the μ meson. Muonium can be formed by allowing a positive μ meson to be stopped in argon gas. The μ meson is obtained from the decay of a π meson, which in turn is produced when a high-energy proton strikes a target nucleus. The μ meson captures an electron from an argon atom to produce muonium in its lowest energy state. (H.H.D.)

28164 THE HIGH ENERGY BEHAVIOR OF SCATTERING AMPLITUDES IN PERTURBATION THEORY. [PART] I. P. G. Federbush (Massachusetts Inst. of Tech., Cambridge) and M. T. Grisaru. Ann. Phys. (N. Y.), 22: 263-73(May 1963). (TID-17565(Pt.I))

A procedure is described for extracting the dominant behavior at high energies of individual Feynman diagrams. This procedure is illustrated by the calculation of several examples, and is applied to the summation of several classes of diagrams in the high energy limit. Although all the examples dealt with concern spinless bosons and nonderivative coupling, the inclusion of spin and more complicated couplings does not alter the basic method. (auth)

28165 THE MANY π-MESON PROBLEM. [PART] II. A. Pais (Inst. for Advanced Study, Princeton). Ann. Phys. (N. Y.), 22: 274-98(May 1963).

Previous work on Nπ-states with isotopic spin $I \leqq 1$ is extended to general values of the isotopic spin. If the maximum allowed I is greater than one, two new features arise that have no counterpart for $I \leqq 1$. There exist interference effects for states with different I but with the same symmetry. For $N \geq 6$ multiple occurrence of a given I can take place for given symmetry. The maximum multiplicity is equal to (I/2) + 1. These two complications make the practical analysis of Nπ-states considerably more involved for $I_{max} > 1$. It is shown that the charge branching ratios for all states with the same I and the same symmetry are the same for each separate occurrence. Two general identities are derived that relate certain branching ratios for different N and different symmetries. Branching ratio tables are given for I = 2, N = 2-6. A complete characterization is given of the set of linearly independent tensors that can be constructed from N 3-vectors. The general specification is: total angular momentum, symmetry, and residual symmetry. The latter is redundant whenever multiple occurrence cannot take place. (auth)

28166 THE HIGH ENERGY BEHAVIOR OF SCATTERING AMPLITUDES IN PERTURBATION THEORY. [PART] II. P. G. Federbush (Massachusetts Inst. of Tech., Cambridge) and M. T. Grisaru. Ann. Phys. (N. Y.), 22: 299-308(May 1963). (TID-17565(Pt. II))

The methods of the previous paper are applied to problems involving particles with spin, and diagrams that require renormalization. Effects of the insertion of self-energy and vertex corrections are illustrated by examples. The class of diagrams describing electron–electron scattering by massive photon exchange, in the absence of photon–photon interactions and with neglect of exchange, is considered. It is argued that individually these diagrams are dominated at high energy by s ln s. Some general rules emerge from the calculations, but rigorous proofs are lacking. (auth)

28167 ON THE DYNAMICAL DETERMINATION OF THE REGGE POLE PARAMETERS. Hung Cheng (California Inst. of Tech., Pasadena) and David Sharp. Ann. Phys. (N. Y.), 22: 481-501(June 1963).

A method, based on the principles of analyticity and unitarity in the t channel, that may help to determine some dynamical properties of the Regge parameters $\alpha(t)$ and $\beta(t)$, is outlined. Various applications of this method and the role of crossing symmetry and unitarity in all three channels in relation to the uniqueness of the solutions are discussed. The unitarity condition satisfied by the partial wave amplitude A(l,t), for l complex, is derived for a relativistic, two-body scattering process. Upon neglecting intermediate states of more than two particles, the unitarity condition can be expressed in terms of Regge parameters. An approximate form for the unitarity condition, accurate at low t, is derived. This form will be used for numerical work. It is shown, in the relativistic case, that the functions $\alpha(t)$ and $\beta(t)$, describing a boson Regge pole, are analytic with only right-hand cuts, in addition to those arising from the crossing of Regge trajectories. The proof is based on two assumptions. The consequence of the existence of essential singularities in relation to $\alpha(t)$ and $\beta(t)$ is especially discussed. The results are modified for the case where the Regge pole is a Fermion. Dispersion relations for $\alpha(t)$ and $\beta(t)$ are obtained. These, together with the unitarity condition, constitute a tentative method for the dynamical determination of the Regge parameters. An extension of the method that is appropriate for discussions of Fermion Regge poles is outlined. The behavior of $\alpha(t)$ and $\beta(t)$ at the elastic or inelastic thresholds is derived, and applied to perform subtractions in the dispersion relation for $\beta(t)$. An approximation for π-π scattering that might possibly lead to a reasonably accurate description of this process is discussed. Estimates of the range of validity of the approximation are made. (auth)

28168 STUDY OF THE SENSITIVITY OF IONOGRAPHIC EMULSIONS AS A FUNCTION OF TEMPERATURE AND APPLICATION TO CORPUSCULAR PHYSICS. Monique Debeauvais-Wack (Corpusculaire du Centre de Recherches Nucleaires, Strasbourgh). Ann. Phys. (Paris) (13), 8: 41-66(Jan.-Feb. 1963). (In French)

The study on the behavior of ionographic emulsions at different temperatures was carried out simultaneously under three essential aspects. A device and a technique were perfected that gave reproducible results. The sensitivity curves were then expressed in equations and interpreted physically. The results were applied to the discrimination of particles at high and low energy. The ionographic emulsions G_5, K_5, C_2, and K_2 were exposed to α, β, γ, and luminous photons at temperatures between 30 and −200°C. (J.S.R.)

28169 SCATTERING OF ELECTROMAGNETIC RADIATION PRODUCED BY HIGH ENERGY ELECTRONS. PART I. Giulio Calamai. Atti Accad. Nazl. Lincei. Rend., Classe Sci. Fis., Mat. Nat., (8) 33: 66-71(July-Aug. 1962). (In Italian)

The deduction of the Thomson formula for the scattering cross section assumes that the electrons are at rest. This hypothesis is not in agreement with fact. The general question is analyzed by a consideration of the reference system and the transfer to the observer system. (J.S.R.)

28170 SCATTERING OF ELECTROMAGNETIC RADIATION PRODUCED BY HIGH ENERGY ELECTRONS. PART II. Giulio Calamai. Atti Accad. Nazl. Lincei. Rend., Classe Sci. Fis., Mat. Nat., (8) 33: 135-41(Sept.-Oct. 1962). (In Italian)

Some approximate formulas for the intensity and the frequency of the scattering radiation are derived. (J.S.R.)

28171 INELASTIC TWO-PRONG π^--NUCLEON INTERACTIONS AT 7 Bev. Ileana Andreesco, M. Calin Besliu, Tatiana Besliu, M. Titus Ciudin, Anisoara Constantinesco, Cleopatra Gherbanovski, and Victoria Pasarica (Université, Bucharest). Compt. Rend., 256: 3847-50(Apr. 29, 1963). (In French)

Inelastic two-prong π^--proton reactions at 7 Bev were studied using nuclear emulsions. The tracks were identified using the multiple scattering method and by grain counting. In the distribution of π moments, a group with moment from 1 to 1.8 Bev was found with angular distribution $\cos\theta = 0.8$ to 1. In order to compare the angular distributions and the moments in the CMS, the known characteristics of a peripheral interaction were found. Two groups of inelasticity were found with maxima $\overline{K}_1 = 0.158$ and $\overline{K}_2 = 0.671$. The reactions having a small inelasticity are produced at the nucleon periphery. The forward asymmetry of protons with high moments seems to indicate a superposition of peripheral and central collisions. The existence of two groups of inelasticity, correlated with two interaction rays and with two values of effective mass, permits a more precise evaluation of the peripheral character of the interaction with a calculated frequency of 0.42 ± 0.15. (J.S.R.)

28172 CERTAIN ISOTROPIC RELATIONS FOR STRANGE PARTICLE PRODUCTION REACTIONS. V. A. Lyul'ka (Kurchatov Inst. of Nuclear Energy, Academy of Sciences, USSR). Izv. Vysshikh Uchebn. Zavedenii, Fiz., No. 2, 24-30(1963). (In Russian)

Isotropic relations for strange particle production were obtained assuming that the hypothesis on isotropic invariability is fulfilled and that in a finite state the two particles have a resonance reaction. Resonance reactions are investigated for: $(\overline{K}N)$, $(\pi\pi)$, $(\overline{K}\pi)$, $(K\overline{K})$, $(\Sigma\pi)$, and (ΣK) systems. (tr-auth)

28173 INTERPRETATION OF THE DIFFERENCE BETWEEN THE PROBABILITIES OF $\pi^\pm \to e^\pm + \nu$ AND $\pi^\pm \to \mu^\pm + \nu$ REACTIONS. R. N. Saliya (Tbilisi State Univ., SSR). Izv. Vysshikh Uchebn. Zavedenii, Fiz., No. 2, 72-4(1963). (In Russian)

The influence of e and μ spirality on the ratio of probabilities for $\pi^\pm \to e^\pm + \nu$ and $\pi^\pm \to \mu^\pm + \nu$ processes was analyzed. (R.V.J.)

28174 INTERPRETATION OF CHARGE SPACE. M. P. Leontovskii (Moscow Inst. of Geological Exploration). Izv. Vysshikh Uchebn. Zavedenii, Fiz., No. 2, 177-8(1963). (In Russian)

An attempt was made to represent a non-physical concept of isospace distributed in ordinary space that could be interpreted as a non-local field theory, where an invariant form factor $f(\xi^2 + \eta^2 + \zeta^2 - \tau^2)$, $\xi = x - x'$, etc., was assigned to the particle with $m_0 \neq 0$, and f = const determines in any 4 space point x, y, z, and t the supersphere $\xi^2 + \eta^2 + \zeta^2 - \tau^2 = \rho^2$. Charge spins given as $\pm 1/2$ (or 0) are constructed and interpreted. (R.V.J.)

28175 POSSIBLE SCHEMES FOR GLOBAL SYMMETRY. David R. Speiser and Jan Tarski (Inst. for Advanced Study, Princeton, N. J.). J. Math. Phys. (N. Y.), 4: 588-612(May 1963).

An attempt was made to determine all possible schemes for global symmetry as representations of groups. All possible schemes that correspond to connected groups were found, but the conclusions about nonconnected groups are incomplete. Physical interpretation of the schemes is discussed, and a detailed summary of group-theoretic methods is included. (auth)

28176 HIGH-ENERGY BEHAVIOR OF A CERTAIN CLASS OF SCATTERING AMPLITUDES IN PERTURBATION THEORY. N. H. Fuchs (Massachusetts Inst. of Tech., Cambridge). J. Math. Phys. (N. Y.), 4: 617-21(May 1963). (TID-18339)

The high-energy behavior for a certain class of Feynman diagrams is determined. The results obtained indicate that Regge-type behavior of scattering amplitude may be associated with the existence of M-particle bound states for arbitrary M. (auth)

28177 THREE-PARTICLE SCATTERING. I. PLANAR CASE. R. C. Whitten (Stanford Research Inst., Menlo Park, Calif.). J. Math. Phys. (N. Y.), 4: 622-33(May 1963).

A formal theory of three-particle scattering in a plane is developed using integral equation methods. Expressions for the scattering amplitude and cross section of elastic and inelastic collisions are derived. The effects of indistinguishability of the colliding particles are discussed. (auth)

28178 ASYMPTOTIC FORM OF THE PROPER SELF-ENERGY FUNCTION IN MANY-PARTICLE SYSTEMS. Donald R. Fredkin (Univ. of California, La Jolla). J. Math. Phys. (N. Y.), 4: 634-6(May 1963).

The asymptotic form at high frequencies of the reciprocal of a two-time thermodynamic Green's function is shown to be a constant. This constant is expressed as the exact expectation value of a second (functional) derivative of the Hamiltonian. (auth)

28179 REPRESENTATIONS OF THE CANONICAL COMMUTATION RELATIONS DESCRIBING A NONRELATIVISTIC INFINITE FREE BOSE GAS. H. Araki (Univ. of Illinois, Urbana) and E. J. Woods. J. Math. Phys. (N. Y.), 4: 637-62(May 1963).

The existence of inequivalent representations of the canonical commutation relations that describe a nonrelativistic infinite free Bose gas of uniform density is investigated, with a view to possible applications to statistical

mechanics. The functional $E(f,g) = (\Psi, e^{i\Phi(f)}e^{i\pi(g)}\Psi)$ is used to describe the inequivalent representations. This functional is calculated for the free Bose gas in a box of volume V, and the limit is then taken as $V \to \infty$. In this way cyclic representations describing an infinite system of particles with a density distribution $\rho(k)$ in momentum space are constructed. For a given $\rho(k)$ the operator algebra generated by the $\phi(f)$, $\pi(g)$ is reducible. For the ground-state representation (all particles in the zero-momentum state), the representation is a direct integral of irreducible representations (analogous to BCS theory). For finite temperatures the situation is complicated by the occurrence of representations which are not type I. The physical significance of the reducibility of the representations is discussed. It is argued that the thermal ensemble for the infinite system is a pure state at zero temperature, although there is some ambiguity as to which operators should belong to the algebra of observables. For finite temperatures, the thermal ensemble seems to be a mixture. The case of an interacting Bose gas is considered briefly. (auth)

28180 REPRESENTATION OF ANNIHILATION OPERATORS IN THE SPACE OF PERIODIC FUNCTIONS. G. H. Derrick (Univ. of New South Wales, Kensington). J. Math. Phys. (N. Y.), 4: 663-6(May 1963).

A representation is given of fermion annihilation operators a_k that satisfy the usual anticommutation relations $\{a_k, a_{k'}^+\} = \delta_{kk'}$. In this representation the a_k operate on periodic function $f(\xi)$ of a real variable ξ. The Hilbert space is the set of all square integrable functions $f(\xi)$ of period 2π, with the scalar product defined by $(f,g) = \int_{-\pi}^{\pi} f^* g \, d\xi$. (auth)

28181 NOTE ON THE ONE-DIMENSIONAL GAS OF IMPENETRABLE POINT-PARTICLE BOSONS. T. D. Schulte (International Business Machines Corp., Yorktown Heights, N. Y.). J. Math. Phys. (N. Y.), 4: 666-71(May 1963).

A one-dimensional gas of impenetrable point-particle bosons is considered. An exact expression for the one-particle density matrix is derived in terms of the Fredholm determinant and resolvent of a certain simple kernel. It is proved that for large r, the density matrix is bounded by const $\times r^{-4/\pi^2}$, and that this implies the absence of a generalized Bose–Einstein condensation, contrary to a recent approximate calculation by Girardeau, who first defined such a condensation. (auth)

28182 WIGNER–ECKART THEOREM AND SIMPLE LIE GROUPS. Jean Ginibre (Laboratoire de Physique Theorique et Hautes Energies, Orsay, France). J. Math. Phys. (N. Y.), 4: 720-6(May 1963).

For simple Lie groups, matrix elements of vector operators (operators that transform according to the adjoint representation of the group) within an irreducible (finite-dimensional) representation, are studied. By use of the Wigner–Eckart theorem, they are shown to be linear combinations of the matrix elements of a finite number of operators. The number of linearly independent terms is calculated and shown to be at most equal to the rank l of the group. l vector operators are constructed explicitly, among which a basis can be chosen for this decomposition. Okubo's mass formula arises as a consequence. (auth)

28183 DETERMINATION OF THE END-POINT ENERGY OF BETA EMITTERS. M. Ramakrishna Raju and Swami Jnanananda (Andhra Univ., Waltair, India). J. Sci. Ind. Res. (India), 21B: 248-51(June 1962). (In English)

A method is described for the determination of the end-point energy of beta emitters. Mass coefficients (μ/ρ) for elements Pt, Au, and Pb with high atomic numbers as absorbers, and W^{185}, Tl^{204}, Y^{91}, P^{32}, and $Sr^{90}-Y^{90}$ as sources were measured. Tables of the obtained mass absorption coefficients for the absorbers and emitters and the computed and experimental end point values in Mev show good agreement with previous data. However, the results from Au are better than those of Pt and Pb. The method is applicable also to very weak β emitters and gives the E_0 values with an accuracy of 3%. (TCO)

28184 THE ABSORPTION OF β-RADIATION AS A FUNCTION OF ATOMIC NUMBER. M. Ramakrishna Raju and Swami Jnanananda (Andhra Univ., Waltair, India). J. Sci. Ind. Res. (India), 21B: 251-4(June 1962). (In English)

An experimental and systematic study of β-ray absorption due to inelastic scattering in elements of different atomic numbers (Z) was carried out for the purpose of ascertaining the extent of validity, under various conditions, of the empirical relations ($\log X = B - AZ^{\alpha}$ where A, B, and α are numerical constants) connecting the thickness (X) of the absorber in electrons/cm^2 and Z. The test arrangement consisted of a brass aperture beveled such that the counter sees the radiation defined by the orifice and effectively reduces the scattered radiation. The results from a P^{32} source are discussed. No particular α value can represent Coulomb scattering for all elements. However, for elements of $Z > 45$, closely similar curves were obtained when X multiplied by $Z^{1/4}$ was plotted against the count rates. Hence, it was concluded that better results can be obtained from elements with $Z > 45$ using an exponent of $1/2$ than previously suggested $1/3$. Studies with alloys (Pt 80% + Rh 20%, and Pt 60% + Rh 40%) confirmed the above rule. The use of W^{185}, Tl^{204}, RaD-E, Y^{91}, or $Sr^{90}-Y^{90}$ source also supports the findings. (OID)

28185 ELASTIC SCATTERING OF CHARGED PIONS BY DEUTERONS AT 300 Mev. V. Devanathan (Univ. of Madras, India). Nucl. Phys., 43: 684-6(June 1963). (In English)

Numerical calculations on the elastic scattering of charged pions by deuterons at 300 Mev are presented, and the agreement with experimental results is satisfactory. (auth)

28186 THEORY OF VAVILOV–CHERENKOV RADIATION IN AN ISOTOPIC OPTICALLY ACTIVE MEDIUM. B. M. Bolotovskii and O. S. Mergelyan. Opt. Spectry. (USSR) (English Transl.), 14: 204-9(Mar. 1963).

Expressions were derived for the field and for the radiation losses due to a point-charge particle moving along a straight line in an optically isotropic medium such as, for instance, a sugar solution. When the velocity of the charged particle exceeds the phase velocity of right (or left-) polarized waves, Vavilov–Cherenkov radiation consisting of right- (or left-) polarized waves is emitted. The angle between the direction of propagation of the emitted wave and the velocity vector of the charge is determined by the refractive index of the corresponding wave. Ionization losses, according to Bohr's formula, appear to be the same in an isotropic optically active medium as in an inactive medium. (auth)

28187 NONLOCAL NUCLEON-NUCLEON INTERACTION. D. A. Giltinan (Case Inst. of Tech., Cleveland) and R. M. Thaler. Phys. Rev., 131: 805-7(July 15, 1963).

It has been explicitly demonstrated that the proton-proton scattering data require that the singlet even parity nucleon-nucleon interaction be nonlocal. This result comes from an examination of the energy dependence of both the

S_0^1 and D_2^1 phase shifts. A nonlocal singlet even parity potential of the form $V(r,r') = V(r)^{1/2} V(r') \; R^{-3}[\exp(-R^{-1}|r-r'|)]/(4\pi R^{-1}|r-r'|)$ is examined. The potential function V(r) is taken to have the form of a monotonic attraction outside a hard core. The radius of the hard core, the depth and range of V(r), and the nonlocal distance R provide four parameters that can be adjusted to fit the experimental values of the singlet scattering length and effective range, and the 310-Mev S_0^1 and D_2^1 phase shifts. For a long-range attractive potential function, such as the Yukawa, the energy dependence of the S_0^1 and D_2^1 phase shifts is strikingly similar to that suggested by the phase-shift analysis of the Yale group. Although the radius of the hard core is decreased somewhat from the local value, a hard core is still required. (auth)

28188 THREE-PARTICLE UNITARITY IN POTENTIAL SCATTERING. A. N. Mitra (Indiana Univ., Bloomington). Phys. Rev., 131: 832-?(July 15, 1963).

A three-particle wave function arising out of a Schrödinger equation with two-body potentials is considered. For simplicity in analysis, the potentials are taken to be of the nonlocal separable type. It is found that at bound-state energies of a three-particle system, the phase of the three-particle amplitude is not equal to that of a pair of its members whose relative energy allows them to be in a physical scattering state. This result disagrees with the prediction of a multiplicative three-particle structure suggested by Blankenbecler, according to which these two phases are necessarily equal. (auth)

28189 PION PRODUCTION IN PION-PION COLLISIONS. Martial L. Thiebaux, Jr. (Univ. of California, Berkeley). Phys. Rev., 131: 854-9(July 15, 1963).

The strip-approximation procedure of Chew and Frautschi is applied in the pion-pion problem to estimate the cross section for the process $2\pi \rightarrow 4\pi$ considered in its full isotopic spin generality. The main results are dependent on S-wave scattering length formulas for low-energy pion-pion scattering. The inelastic cross sections are found to attain maxima not greater than 0.016 mb at total energies of about $11m_\pi$. Arguments based on the geometry of the double spectral functions suggest these results are accurate in the energy range from threshold at $4m_\pi$ to $8m_\pi$. On the basis of an estimation that is necessarily crude since the strip approximation breaks down in this case, the cross section for ρ production is found to go through a maximum of about 0.5 mb at an energy of $13m_\pi$, but ρ production is probably not significant at energies below $8m_\pi$. An attempt is also made to estimate quantitatively to what extent the four final pions emerge in two well-defined pairs and it is found that the effect is rather indistinct. (auth)

28190 RARE DECAY MODES OF K*. Mitchel J. Sweig (Univ. of Chicago). Phys. Rev., 131: 860(July 15, 1963).

Assuming ρ-meson dominance, the branching ratio $\Gamma(K^* \rightarrow K\pi\pi)/\Gamma(K^* \rightarrow K\gamma)$ was calculated to be $1/_{23}$. Estimating the $K^*K\rho$ coupling from unitary summetry and the decay of the π^0 gives $\Gamma(K^* \rightarrow K\gamma)/\Gamma(K^* \rightarrow K\pi) \cong 0.15\%$, a factor of 5 lower than previous estimates. (auth)

28191 LOW-ENERGY PION-PION SCATTERING. Kenneth Smith and Jack L. Uretsky (Argonne National Lab., Ill.). Phys. Rev., 131: 861-7(July 15, 1963).

The partial-wave dispersion relations for pion-pion scattering is deduced from the Mandelstam representation for the scattering amplitude. The contribution of the left-hand cut was calculated from $\lambda\phi^4$ perturbation theory. The s-wave and p-wave amplitudes were obtained numerically and found to agree closely with those obtained by Chew, Mandelstam, and Noyes who proceeded from a different viewpoint. (auth)

28192 BETA-DECAY BRANCHING RATIO OF THE LAMBDA HYPERON. Robert P. Ely (Univ. of California, Berkeley), George Gidal, George E. Kalmus, Larry O. Oswald, Wilson M. Powell, William J. Singleton, Frederick W. Bullock, Cyril Henderson, David J. Miller, and F. Russell Stannard. Phys. Rev., 131: 868-74(July 15, 1963). (UCRL-10678)

Lambda hyperons were produced by K^- mesons at rest in a heavy-liquid bubble chamber filled with a mixture of 76% CF_3Br–24% C_3H_8 by weight. A search for the β-decay mode $\Lambda \rightarrow p + e^- + \bar{\nu}$ was made. A total of 192,000 Λ decays of the type $\Lambda \rightarrow p + \pi^-$ was observed. Three methods of separating the β-decay mode from the mesonic decay and from other forms of background are discussed. The most successful method of calculating the branching ratio $r = (\Lambda \rightarrow p + e^- + \bar{\nu})/[(\Lambda \rightarrow p + \pi^-) + (\Lambda \rightarrow n + \pi^0)]$ made use of the Λ_β decays identified by the electron's stopping or starting to curl up in the chamber; also, r was calculated from Λ_β decays in which negative secondaries left the chamber. The nonmesonic nature of these secondaries was established either by δ rays or by decay kinematics. The values of r obtained by the different methods all agree within the errors. The best value obtained is $r = (0.82 \pm 0.13) \times 10^{-3}$. (auth)

28193 UNITARY IMPULSE APPROXIMATION. Leonard Rosenberg (Univ. of Pennsylvania, Philadelphia). Phys. Rev., 131: 874-82(July 15, 1963).

With the aid of multiple scattering expansions, Blankenbecler's generalized unitarity relation is derived for a multichannel three-body potential scattering problem. A matrix representation of the scattering amplitudes is obtained in the form of Heitler's integral equation, with the K matrix replaced by a matrix N, so that generalized unitarity is automatically satisfied if N has no physical cut in the total energy variable. A simple, physically reasonable, choice for N leads to representations of the inelastic amplitudes that have the form of initial- (or final-) state interaction corrections to the impulse approximation. With the elastic amplitude given, no sums over three-body phase space appear. The elastic amplitude itself is obtained as the solution of an integral equation that sums all diagrams that are iterations of the basic impulse approximation diagram. It is explicitly demonstrated that the partial-wave amplitudes thus obtained must satisfy unitarity even when the impulse approximation is nonunitary. A convergent iterative solution is presented that treats the effects of longer ranged forces first and should be appropriate for high-energy diffraction scattering. Rearrangement collisions are treated in a similar way. (auth)

28194 TREATMENT OF EXCHANGE IN SCATTERING PROCESSES. M. Bolsterli (Universitet, Copenhagen). Phys. Rev., 131: 883-5(July 15, 1963).

The scattering amplitude for processes in which either the initial state involves a single particle plus a bound group is split into direct and exchange parts. It is shown that these can be determined from the direct wave function for the initial state, which satisfies a single-particle differential equation without exchange, and the asymptotic plane-wave part of the wave function of the final state. (auth)

28195 UNSTABLE PARTICLES IN S-MATRIX THEORY. Daniel Zwanziger (Univ. of California, Berkeley; Università, Rome; and Istituto Nazionale di Fisica Nucleare, Rome). Phys. Rev., 131: 888-?(July 15, 1963).

The consequences of the existence of complex poles in scattering amplitudes, corresponding to resonances or unstable particles, are investigated. Specific examples show that corresponding to such poles are normal threshold cuts lying near the physical region and that cause wooly cusps in scattering cross sections. The discontinuity across such a cut is expressed by a unitarity-like relation in terms of unphysical amplitudes with unstable external particles defined by the residues of the complex poles. More generally, it is shown that the Landau equations for the singularities must be extended to include all unstable as well as stable particles. The Cutkosky formulas specify the corresponding discontinuities in terms of the physical and unphysical amplitudes. (auth)

28196 SCATTERING OF GAMMA RAYS IN LAMINAR MEDIA. Dominic J. Raso (Technical Operations Research, Burlington, Mass.). Radiation Res., 19: 384-91(June 1963).

A multipurpose γ-ray Monte Carlo program for describing the emergent (backscattering or transmitted) characteristics (E,ω,z) of photons scattered by flat slabs was written. The program was set up to investigate γ-ray backscattering, absorption, and transmission in one, two, or three layers of different materials. The information that may be obtained includes: the number albedo or transmitted; the energy albedo or transmitted; the angular distribution of the emergent number, energy, or dose; and the fraction of energy deposited in layers of the medium. (auth)

28197 RESONANCE MODEL IN NUCLEON-ANTINUCLEON ANNIHILATION. G. Cocho Gil (Princeton Univ., N. J.). Rev. Mex. Fis., 11: 215-42(1962). (In English)

The $\bar{N}N$ annihilation at rest is analyzed assuming that the final-state interactions are so strong that instead of an n-particle phase space, actually a 2 particle phase space is present. Considering as particles the π, ρ, and ω particles, and taking into account only the one-nucleon exchange diagrams, expressions are derived for the charge multiplicity distribution and for the one-pion energy spectrum. These expressions are functions of the $\bar{N}N\pi$, $\bar{N}N\rho$, and $\bar{N}N\omega$ effective coupling constants. These are used as parameters which are chosen to fit the experimental charge multiplicity distribution. When these values are used in the expression for the energy spectrum, good agreement is obtained with the experimental data, except that the present model yields sharp peaks, which are not evident in the experimental data. In the present model, these peaks come from the processes $\bar{N} + N \rightarrow \pi + \rho$, $\bar{N} + N \rightarrow \pi + \omega$. (auth)

28198 INELASTIC PROCESSES IN PION–PION SCATTERING AND ITS EFFECT ON THE FORM FACTOR OF THE NUCLEON. A. Pignotti (Universidad, Buenos Aires). Rev. Union Mat. Arg., Asoc. Fis. Arg., 21: 69-75(1962). (In Spanish)

The modifications appearing in the form factor introducing phenomenologically inelastic processes in the amplitude of pion-pion scattering are estimated. The contributions of intermediate states of more than two pions in the imaginary part of the form factor are not considered. The results seem to favor a relatively low value for the parameter a, and to suggest that the production of two pions is the dominant inelastic process in pion-pion scattering. (J.S.R.)

28199 π^- + C INTERACTIONS AT 915 Mev. 1. SIMULATION OF π^- + C INTERACTIONS USING THE MONTE CARLO METHOD. Ernesto Garcia Camerero, Antonio Gentile, and Emma Perez Ferreira (Comision Nacional de Energia Atomica and Facultad de Ciencias Exactas and Naturales, [Buenos Aires]). Rev. Union Mat. Arg., Asoc. Fis. Arg., 21: 91-103(1962). (In Spanish)

The angular distribution and pulse distribution of the final products of the interaction of 915-Mev pions with carbon are calculated from the predictions of the independent particle model. The nucleons are treated as free particles, taking into consideration only their Fermi pulse, in such a way that the total energy of the corresponding pion-nucleon system will vary over a wide range. The possible effects of the nuclear potential at the nuclear edge are neglected. It is assumed that the isobar is excited in the inelastic processes. The calculation results were systematized for their comparison with experimental data on the analysis of pion collisions observed in a propane bubble chamber. (tr-auth)

28200 STRONG INTERACTIONS OF ELEMENTARY PARTICLES AT HIGH-ENERGIES. V. N. Gribov. Vestn. Akad. Nauk SSSR, 33: No. 4, 3-8(Apr. 1963). (In Russian)

An elementary particle is defined, and an analysis is made of strong interactions and their relation to the Regge diagram. (R.V.J.)

28201 A FUNCTIONAL METHOD FOR CONDENSED SYSTEMS. W. Brenig and H. Wagner (Univ. of California, San Diego and Technische Hochschule, Munich). Z. Physik, 173: 484-9(1963). (In English)

Schwinger's functional method was applied to the Green functions of the many-body problem. By including the anomalous Green functions introduced by Gorkov, a formalism resulted which permitted in a natural way the treatment of systems showing superfluid properties (condensed systems). (auth)

28202 MANY-QUANTUM PROCESSES IN TWO-STATE SYSTEMS. S. Wilking (Technische Hochschule, Karlsruhe, Ger.). Z. Physik, 173: 490-508(1963). (In German)

Experimental data on n-quantum transitions between spin-Zeeman levels of protons were compared with results of n-th order quantum mechanical perturbation calculations. The comparison concerns the transition probabilities and their dependence on: the energy difference of the levels, the angle between the direction of quantization and the magnetic vector of the inducing field, and the length of the time interval during which the perturbation acts on the proton. (auth)

28203 PERTURBATION THEORY APPROXIMATION FOR RANDOM PERTURBATION TIMES. S. Wilking (Technische Hochschule, Karlsruhe, Ger.). Z. Physik, 173: 509-18(1963). (In German)

A quantum theoretical perturbation approximation was developed which, in contrast to the usual method, is not restricted to a final time interval. The calculation was applied to n-quantum transitions between the spin-Zeeman levels of protons. (auth)

28204 HIGH PARTIAL WAVES IN THE PHOTOPRODUCTION OF π^0 MESONS ON PROTONS. B. B. Govorkov, S. P. Denisov, A. I. Lebedev, and E. V. Minarik (Lebedev Inst. of Physics, Moscow). Zh. Eksperim. i Teor. Fiz., 44: 1463-9(May 1963). (In Russian)

The angular distribution of π^0 mesons produced on protons by 181 ± 10 Mev photons is measured. The π^0 mesons are recorded by counting coincidences between two decay γ quanta with aid of a scintillation counter telescope. A comparison of the data with results of calculations based on the one-dimensional dispersion relations leads to a discrepancy, which may indicate that resonance meson states contribute to the process under consideration. (auth)

28205 INELASTIC π^-p INTERACTIONS AT AN ENERGY OF 7 Bev. D. K. Kopylova, V. B. Lyubimov, M. I. Podgoretskii, Kh. Rizaev, and Z. Trka (Joint Inst. of Nuclear Research, Dubna, USSR). Zh. Eksperim. i Teor. Fiz., 44: 1481-6(May 1963). (In Russian)

154 inelastic π^-p interaction events involving the emission of secondary protons with momenta between 180 and 500 Mev/c are selected from stereoscopic photographs of a propane bubble chamber irradiated by a beam of 6.8 ± 0.6 Bev/c π^- mesons. An analysis of the events indicates that they possess some features characteristic of peripheral interactions. These features are more pronounced in two-prong interactions than in four-prong interactions. A criterion for specifying interactions involving free protons is considered. It is connected with calculation of the so-called missing mass. With this criterion it is shown in particular that in four-prong stars the fraction of background interactions with carbon is much higher than in two-prong stars. (auth)

28206 SOME RULES FOR A UNIFIED CLASSIFICATION OF ELEMENTARY PARTICLES. Ya. P. Terletskii (Moscow State University). Zh. Eksperim. i Teor. Fiz., 44: 1583-6(May 1963). (In Russian)

It is shown that leptons can be included in a consistent manner in a unified classification of elementary particles if muons and muon neutrinos are assumed to have a unit hypercharge. The position of each elementary particle is determined by its spin and three elementary numbers, each of which can assume only the values 0 or ±1. The classification proposed is consistent with the law of conservation of hypercharge for all types of lepton decay. (auth)

28207 ELASTIC SCATTERING OF 8.35-Bev PROTONS ON PROTONS. Do In Seb, L. F. Kirillova, and M. G. Shafranova (Joint Inst. of Nuclear Research, Dubna, USSR). Zh. Eksperim. i Teor. Fiz., 44: 1487-92(May 1963). (In Russian)

An accurate value of the differential cross section for pp scattering at 8.35 Bev, obtained by measurements in photographic emulsions, is presented. The data are analyzed on the basis of the Regge pole technique and are compared with data from other experiments. The total pp elastic scattering cross section is found to be (10.8 ± 0.8) mb; the mean square interaction radius is (1.07 ± 0.08) f. (auth)

28208 ON PERIPHERAL PION-NUCLEON INTERACTIONS AT 7 Bev. Ya. Bem, V. Petrzhilka, and M. Suk (Czechoslovakian Coll. of Tech., Prague). Zh. Eksperim. i Teor. Fiz., 44: 1497-9(May 1963). (In Russian)

On the basis of criteria from 951 π^-N interactions, 101 reaction events are selected that can be described by the one-pion-exchange model. (auth)

28209 SPECTRAL REPRESENTATIONS OF A FIVE-TAIL DIAGRAM IN PERTURBATION THEORY. O. I. Zavyalov and V. P. Pavlov (Inst. of Mathematics, Academy of Sciences, USSR). Zh. Eksperim. i Teor. Fiz., 44: 1500-8(May 1963). (In Russian)

The analytical properties of an inelastic scattering amplitude, represented by a loop diagram of the fifth order with arbitrary masses on the lines, are considered. A double spectral representation of the Mandelstam type is obtained. A number of restrictions on the masses and fixed invariants required for the existence of the spectral representation are found. Even the weakest of these restrictions are violated in the physical region and the representations do not exist because of singularities in the complex plane of the spectral invariant. (auth)

28210 CALCULATION OF THE DOUBLET NEUTRON-DEUTERON SCATTERING LENGTH IN THE THEORY OF ZERO RANGE FORCES. G. S. Danilov and V. I. Lebedev (Ioffe Inst. of Physics and Tech., Academy of Sciences, USSR). Zh. Eksperim. i Teor. Fiz., 44: 1509-17(May 1963). (In Russian)

The scattering length for a neutron scattered on a deuteron in the $S_{1/2}$ state is calculated within the framework of the zero-range-forces theory. The value obtained is $0.48 \cdot 10^{-13}$ cm, and agrees with the experimental value. (auth)

28211 $K^+ \to 3\pi$ DECAY AND $\pi\pi$ INTERACTION. V. V. Anisovich (Ioffe Inst. of Physics and Tech., Academy of Sciences, USSR). Zh. Eksperim. i Teor. Fiz., 44: 1593-1602(May 1963). (In Russian)

The experimental data are compared with the formulas for $K^+ \to 3\pi$ decays derived under the assumption that the $\Delta T = 1/2$ rule holds and that a_0, $a_2 \lesssim 1$ (a_0 and a_2 are the π meson scattering lengths in S-states with isotopic spins 0 and 2 in $\hbar/\mu c$ units). It is shown that the formulas are consistent with the experiments on the condition that a_0 and a_2 satisfy the relations $|a_0 a_2| \leq 0.25$ and $a_0^2 - a_0 a_2 + 0.5\, a_2^2 \sim 0.7 \pm 1$. Experimental data do not yield more accurate information about a_0 and a_2. An integral equation for the decay amplitude is written down, without any assumption regarding the smallness of a_0 and a_2 being made. The integral equation has a single solution and can be solved numerically. (auth)

28212 ASYMPTOTIC BEHAVIOR OF SCATTERING AMPLITUDES AND THE PROBLEM OF (GHOSTS) ON THE TRAJECTORIES OF VACUUM REGGE POLES. V. B. Berestetskii (Inst. of Theoretical and Experimental Physics, USSR). Zh. Eksperim. i Teor. Fiz., 44: 1603-11 (May 1963). (In Russian)

Asymptotic expressions for elastic $\pi\pi$, πN, and NN scattering amplitudes are obtained for the region in which the main vacuum Regge pole passes through the value j = 0. Gell-Mann's hypothesis that the residues vanish for physical partial amplitudes is in agreement with the analytical properties of these residues at j = 0, and ensures finiteness of all scattering amplitudes. (auth)

28213 INTEGRAL REPRESENTATION OF A SQUARE DIAGRAM WITH AN ANOMALOUS MASS RATIO. Yu. A. Simonov. Zh. Eksperim. i Teor. Fiz., 44: 1622-7(May 1963). (In Russian)

An integral representation is employed for writing down the double dispersion relation (with respect to energy and transferred momentum) for a square diagram with arbitrary nondecay masses. The relation sought is the sum of three integrals of which the first is the same as the usual Mandelstam representation. Upon transition to a normal mass ratio the last two integrals vanish. (auth)

28214 TWO-PHOTON ANNIHILATION OF POLARIZED ELECTRONS AND POSITRONS. A. A. Tkachenko (Leningrad State Univ.). Zh. Eksperim. i Teor. Fiz., 44: 1668-74(May 1963). (In Russian)

The differential cross section for two-photon annihilation of free polarized electrons and positrons is derived in relativistically invariant form, for the case in which linear γ polarizations are analyzed in the final state. (auth)

28215 γ-NEUTRINO CORRELATION IN μ MESON CAPTURE. N. P. Popov (Ioffe Inst. of Physics and Tech., Academy of Sciences, USSR). Zh. Eksperim. i Teor. Fiz., 44: 1679-86(May 1963). (In Russian)

A correlation formula for the directions of emission of neutrinos and γ quanta and the direction of the μ meson

beam is obtained for the case of allowed K capture. It is shown that the $\gamma\nu$ correlation in the capture of unpolarized μ mesons is very sensitive to the magnitude and sign of the induced pseudoscalar interaction constant. A general formula is presented for correlation in K capture of μ mesons of any order of forbiddenness. (auth)

28216 ASYMPTOTIC VALUE OF THE VERTEX FUNCTION IN THE (SINGLE LOGARITHMIC) APPROXIMATION. S. Ya. Guzenko and P. I. Fomin (Inst. of Physics and Tech., Academy of Sciences, Ukrainian SSR). Zh. Eksperim. i Teor. Fiz., 44: 1687-94(May 1963). (In Russian)

The ultrarelativistic asymptotic value of the vertex function is calculated in quantum electrodynamics in the single-logarithmic approximation. (auth)

28217 PERTURBATION THEORY AND FERMION REGGE POLES IN ELECTRODYNAMICS. G. V. Frolov (Radium Inst., Academy of Sciences, USSR). Zh. Eksperim. i Teor. Fiz., 44: 1746-7(May 1963). (In Russian)

Previously Gell-Mann, et al. postulated (Phys Rev Let., 9, 275, 1962) that asymptotic behavior of Compton-effect amplitude on electrons at large β and finite μ, obtained using the perturbation theory, may be explained, considering the electron as a Regge pole. An attempt was made to show that the asymptotic behavior described by a fermion Regge pole of a given sign disagrees with perturbation theory. (R.V.J.)

28218 ASYMPTOTIC RELATIONS FOR CROSS SECTIONS OF SCATTERING AT LARGE ANGLES. V. G. Gorshkov and G. V. Frolov (Ioffe Inst. of Physics and Tech., Academy of Sciences, USSR and Radium Inst. of the Academy of Sciences, USSR). Zh. Eksperim. i Teor. Fiz., 44: 1747-9(May 1963). (In Russian)

Published data indicate that the method of Regge poles can be used for determining asymptotic relations between cross sections of various scattering processes at small angles. Similar relations for scattering processes at large angles were postulated by Pomeranchuk. An attempt was made to develop such relations for certain specific processes—Compton effect on nucleons, photoproduction of pions, and π-N scattering. (R.V.J.)

Neutron Physics

28219 (ANL-6709) 1559/RE: A CODE TO COMPUTE RESONANCE INTEGRALS IN MIXTURES. Charles N. Keiber (Argonne National Lab., Ill.). May 1963. Contract W-31-109-eng-38. 20p.

The computer program 1559/RE is an experimental IBM-704 code in FORTRAN language for computing the resonance integrals of isotopes in mixtures in the presence of hydrogenic moderation. There may be up to four isotopes, each with no more than 75 resolved resonance levels. Doppler broadening and interference scattering are included. No estimate is made of contributions from unresolved resonances. Typical running times are 30 min (with no Doppler broadening) to 90 min (with Doppler broadening) for problems involving 67 levels and unit lethargy widths. Input and theory are discussed, and a typical listing is given. (auth)

28220 (EUR-106.f) DIFF — UN PROGRAMME FORTRAN 7090 POUR DETERMINER LES CONSTANTES DE DIFFUSION NEUTRONIQUE RELATIVES A UN CALCUL A SIX GROUPES. (DIFF — A 7090 Fortran Program to Determine Neutron Diffusion Constants Relating to a Six-Group Calculation). C. Pleinevaux (European Atomic Energy Community. Nuclear Research Center, Ispra, Italy). 1962. 28p.

The computer program DIFF, in Fortran for the IBM 7090, for calculating the neutron diffusion coefficients and attenuation areas (L^2) necessary for multigroup diffusion calculations for reactor shielding is described. Diffusion coefficients and values of the inverse attenuation length are given for a six group calculation for several interesting shielding materials. (D.C.W.)

28221 (EUR-107.f) DÉTECTION DE LA PÉNÉTRATION DES NEUTRONS RAPIDES DANS L'EAU AU MOYEN DE DÉTECTEURS A SEUIL. (Detection of the Penetration of Fast Neutrons in Water by Means of Threshold Detectors). R. Nicks and C. Pleinevaux (European Atomic Energy Community. Nuclear Research Center, Ispra, Italy). 1962. 13p.

Theoretically determined activation rates for Al^{27}, Fe^{56}, Ni^{58}, P, and S^{32} threshold detectors immerged in H_2O and irradiated by 2, 4, 6, 8, 10, and 14-Mev neutrons are given. Some results on In activation are also included. (D.C.W.)

28222 (KAPL-M-RPC-1(Rev.1)) TRAM FOR THE PHILCO 2000. R. A. Pfeiffer, J. E. Tuecke, and W. W. Stone (Knolls Atomic Power Lab., Schenectady, N. Y.). Mar. 28, 1963. Contract W-31-109-eng-52. 40p.

TRAM, a three-dimensional neutron transport program for the Monte Carlo determination of spatial and spectral variations of the neutron population below 100 ev, is described. The present version, for the Philco 2000, is a rewrite of the 704 program with provision for larger problems and more flexible geometries. This version also includes a simplified input preparation scheme with extensive program checking for input errors, and diagnostic print-outs. The principal application of TRAM is in the calculation of proportionate captures in the various regions of a reactor cell. (auth)

28223 (NAA-SR-Memo-8427) ANALYTICAL TECHNIQUES FOR THE CALCULATION OF THE ORNL TOWER SHIELD EXPERIMENTS. PART I. ANNEX-1. R. S. Hubner (Atomics International. Div. of North American Aviation, Inc., Canoga Park, Calif.). Apr. 23, 1963. Contract [AT(11-1)-Gen-8]. 144p.

The computer program, ANNEX-1, consisting of plain sampling Monte Carlo techniques for analysis of the scattering of a monidirectional neutron beam from a cylindrical volume is described. The beam may be incident upon the cylindrical target surface from any direction and may have an energy dependence as well as a spatial intensity dependence. The energy dependent scattered flux per incident total flux is obtained for any desired direction; uncollided flux is omitted. Program restrictions, operation and input preparation are given. (auth)

28224 (TID-18884) TIME-DEPENDENT SOLUTION OF THE NEUTRON TRANSPORT EQUATION IN A FINITE SLAB (thesis). Quarterly Progress Report, September–December 1962. Robert L. Bowden, Jr. (Virginia Polytechnic Inst., Blacksburg). Jan. 1963. Contract AT(40-1)-2686. 139p.

The solution of an initial-value problem involving the one-velocity, time-dependent neutron transport equation in slab geometry is reported. The method of solution is based on the normal-mode expansion of K. M. Case and uses the existence theorems of J. Lehner and G. M. Wing. The general (linear) neutron transport equation is formally reduced to the one-velocity, isotropic-scattering transport equation, and plane and azimuthal symmetry is assumed. The initial-value problem is then written as the solution of a source free transport equation describing the time-history of the neutron distribution in a slab surrounded by a vacuum, subject to no-entry boundary conditions. Con-

tinuum, discrete, and general solutions are obtained for the eigenvalue problem. The eigenfunctions Ψ_{α_j} are found, and Fredholm integral equations are derived for the expansion coefficients. The existence of solutions to these integral equations is demonstrated. Furthermore, exact expressions for the distribution of the eigenvalues α_j as functions of c and a (where a is slab thickness, c is the mean number of secondaries/single collision) are derived; and calculations are made for ca ≤ 20 (with a measured in mean free paths). Similarly, the expression for $\Psi^*_{\alpha_j}$ is derived. An expression for u_i (the required direction cosine) is obtained by use of a Green's function that is an expansion of elementary solutions, and Fredholm integral equations are derived for the expansion coefficients. The existence of solutions of these integral equations is also demonstrated. Finally, in the limit of large time and slab widths the solution is shown to have properties expected from elementary diffusion theory. (auth)

28225 (TID-18885) EXISTENCE AND UNIQUENESS THEOREMS FOR THE NEUTRON TRANSPORT EQUATION. K. M. Case and P. F. Zweifel (Michigan. Univ., Ann Arbor). Apr. 1963. 35p.

In an attempt to understand the conditions under which the neutron transport equation has solutions, and the properties of those solutions, a number of existence and uniqueness theorems are proved. The properties of a solution are found to be closely related to the boundedness of the source as well as to certain velocity-space integrals of the scattering kernel. Both time-dependent and time-independent equations are considered, as are the time-dependent and time-independent adjoint equations. Although only a very few of all possible existence and uniqueness theorems for these equations are considered here, the work may serve as a guide to the treatment of similar problems. (auth)

28226 (UCRL-7267) APPLICATION OF THE DEBYE MODEL TO SCATTERING OF NEUTRONS FROM CRYSTALS. R. N. Stuart (California. Univ., Livermore. Lawrence Radiation Lab.). Mar. 5, 1963. Contract W-7405-eng-48. 31p.

The Debye model is used to calculate the scattering of neutrons by a simple cubic Bravais lattice. The scattering equations are derived by use of the Van Hove formalism, and calculated differential and total cross sections are displayed. (D.C.W.)

28227 (WAPD-T-1392) SOLUTION OF THE TRANSPORT EQUATION IN A FINITE SLAB BY POLYNOMIAL EXPANSION. D. C. Anderson and B. D. O'Reilly (Westinghouse Electric Corp. Bettis Atomic Power Lab., Pittsburgh). Aug. 1961. Contract AT(11-1)-Gen-14. 28p.

An approximate method for solving the one-dimensional transport equation in a slab with arbitrary boundary conditions by the method of polynomial expansion is developed. The present analysis, for simplicity, is restricted to the monoenergetic case. Selected calculations are compared with exact results and with the results of discrete ordinates calculations employing difference solutions of the spatial differential equations. (auth)

28228 (WAPD-T-1589) DATA FLOW AND STORAGE ALLOCATION FOR THE PDQ-5 PROGRAM ON THE PHILCO-2000. C. J. Pfeifer (Westinghouse Electric Corp. Bettis Atomic Power Lab., Pittsburgh). Mar. 1963. Contract AT-11-1-GEN-14. 6p.

PDQ-5 is a FORTRAN program that solves the two-dimensional few-group time-independent neutron-diffusion equations. The discrete approximation of these equations results in a matrix eigenvalue problem. The iteration technique (three-line cyclically reduced successive over-relaxation) employed by the program to effect the inversion of very large matrices requires sweeping of data repetitively from magnetic tapes. The internal speed of the computer relative to tape speed is such that, if only one iteration were performed per tape sweep, the program would run effectively at tape speed despite efficient buffering of the tape data. The device employed in PDQ-5 to circumvent this problem is the use of simultaneous iterations; i.e., more than one iteration per tape sweep. The storage allocation described is that used to support a variable number of simultaneous iterations. (auth)

28229 ENERGY-DEPENDENT NEUTRON TRANSPORT THEORY. I. CONSTANT CROSS SECTIONS. Joel H. Ferziger and A. Leonard (Stanford Univ., Calif.). Ann. Phys. (N. Y.), 22: 192-209(May 1963).

A complete set of solutions to the Boltzmann equation with energy transfer, but constant cross sections, is given for the case of plane symmetry. The neutron flux is expanded in terms of the eigenfunctions of the energy transfer operator; this reduces the problem to a denumerable set of one-velocity transport problems of the type that were studied by Case. Completeness and orthogonality relations follow almost directly from the work of Case. Several of the standard neutron transport problems are solved in the energy-dependent case and numerical results are obtained for the heavy gas model. These results are then compared with diffusion theory and it is found that the diffusion theory results are correct only for small absorption and the first energy mode. (auth)

28230 VARIATIONAL CALCULATIONS OF THE EXTRAPOLATION LENGTH OF SOME FUEL ELEMENTS, WITH APPLICATION TO THE THERMAL UTILIZATION FACTOR. P. Basso, B. Montagnini, and V. Pierpaoli (AGIP Nucleare, Milan). Energia Nucl. (Milan), 10: 237-46(May 1963). (In English)

The application of the results of a previous work concerning the extrapolation length of fuel and absorber elements to the calculation of the thermal utilization factor is discussed. Some calculations were performed to check the accuracy of the various approximations used. In all cases examined, the method of homogenizing the element proved to be sufficiently accurate, as far as the extrapolation length is concerned. When this quantity is determined, an elementary formula gives explicitly the thermal utilization factor (in the one-group theory). (auth)

28231 A MODIFIED TWO-GROUP THEORY MODEL. G. B. Zorzoli (CISE, Milan). Energia Nucl. (Milan), 10: 280(May 1963). (In English)

The problem of correctly describing the neutron balance in the epithermal group when a two-group diffusion equation system is written to describe neutron balance in a thermal reactor is discussed. A three-group model is proposed, which can be reduced to a modified two-group system. (M.C.G.)

28232 AN ABSOLUTE CALIBRATION OF THE NATIONAL BUREAU OF STANDARDS THERMAL NEUTRON FLUX. E. J. Axton (National Physical Lab., Teddington, Middx, Eng.). J. Res. Natl. Bur. Std, 67A: 215-17(May-June 1963).

The NBS Thermal Neutron Flux was calibrated in terms of the gold thermal neutron capture cross section. The effective thermal neutron flux density is estimated to be 4307 ± 2 percent n/cm^2 sec in September 1961. This figure is in agreement with a recent value quoted by the NBS. (auth)

28233 TWO GROUP IMPORTANCE FUNCTIONS WITHOUT SOLVING THE ADJOINT EQUATIONS. J. Lewins. Nucl. Energy, 164-5(June 1963).

Equations that relate the two group diffusion equations and their corresponding adjoint functions linearly to the neutron fluxes are presented. The equations are given explicitly for the two group model in terms of the moderator and fuel mixture thermal absorption cross section and neutron yields per thermal neutron absorbed. The principal assumption used in deriving these relations is that of the single moderator and single fuel mixture, though the densities of either may vary arbitrarily in the reactor. The overall normalization of either fluxes or importances is arbitrary. (C.E.S.)

28234 NUMERICAL DETERMINATION OF FLUX PERTURBATION BY FOILS. Friedrich H. Helm (Argonne National Lab., Ill.). Nucl. Sci. Eng., 16: 235-8 (June 1963). (TID-18175; UAC-7097).

The method for evaluating thermal neutron flux measurements by foils, which was developed by Ritchie and Eldridge, has proven to be a valuable tool for the experimenter. However, there is some difficulty in obtaining the proper definitions and numerical quantities essential for its application. Especially, there developed a need for an easy way to find the function $g(\gamma,\tau)$. Therefore, a compilation was made of all important definitions, exact and approximate relations, and numerical values pertaining to this problem. (auth)

28235 ON THE LINEAR EXTRAPOLATION DISTANCE. G. C. Pomraning (General Electric Corp., Pleasanton, Calif.). Nucl. Sci. Eng., 16: 239-40(June 1963).

In the calculation of thermal worth of control elements in an assembly by P-1 diffusion theory, the condition $-(1/\phi)n\nabla\phi = 1/d$ usually is assumed, where ϕ = flux, n = unit normal vector pointing into the control region, and d = linear extrapolation distance. A general discussion of d is given, and two simple methods are suggested for improving the value of d. The first method comprises treating the source as spatially constant in a semi-infinite halfspace; d becomes infinite for a pure absorber and hence this method is incorrect for strong absorbers. The second method is similar to the first except that allowance is made for exact transport leakage. Expansions are given of the equations for d/λ_{tr}, where λ_{tr} = transport mean free path. (D.L.C.)

28236 THE SCATTERING OF SLOW NEUTRONS BY COMPLEX MAGNETIC STRUCTURES. S. V. Maleev, V. G. Bar'yakhtar, and R. A. Suris (Ioffe Inst. of Physics, Leningrad). Soviet Phys.-Solid State (English Transl.), 4: 2533-9(June 1963).

Elastic scattering by magnetic substances possessing complex magnetic structures is examined. General expressions are obtained for the cross section and the polarization for this kind of scattering, assuming that the incident neutrons also are polarized. The problem of reconstructing the actual magnetic structure from experimental data was analyzed. Formulas are given for calculating the cross sections and polarizations in a number of specific structures. (auth)

Nuclear Properties and Reactions

28237 (AE-102) A SELECTIVE NEUTRON DETECTOR IN THE kev REGION UTILIZING THE $^{19}F(n,\gamma)^{20}F$ REACTION. J. Konijn (Aktiebolaget Atomenergi, Stockholm). May 1963. 19p.

The Research Swimming-Pool Reactor R2-0 at Studsvik was used to investigate some resonance and threshold reactions for neutron flux measurements. This reactor, equipped with MTR type fuel elements, has a maximum neutron flux of about $10^{12n}/cm^2$ sec., giving a thermal output of 100 kw. A pneumatic rabbit was constructed to bring the samples in activation position, in which there was 15 cm H_2O and 1.2 cm Al between reactor and foil. A covering, containing 1.22 g B^{10}/cm^2 was pushed over the cadmium-covered Al tube of the rabbit. The activation of the foil was measured with a NaI(Tl)-scintillation spectrometer. From the gamma ray spectrum, recorded on a 256 channel pulse height analyzer, the epithermal neutron flux per unit of in E interval was calculated. The activation cross section for $F^{19}(n,\gamma)F^{20}$ in the B^{10}-covering was computed to be 16 mb, and about 60% of the induced activity is due to neutrons in the energy range of 20-70 kev. The experimental results were compared with those obtained from the more known resonance reactions $Cu^{63}(n,\gamma)Cu^{64}$ and $Al^{27}(n,\gamma)Al^{28}$. The epithermal neutron flux experiments are in good agreement with each other. The fast neutron flux measurements were carried out with the following threshold detectors: $Au^{197}(n,n')Au^{197m}$, $Ni^{58}(n,p)Co^{58}$, $Al^{27}(n,p)Mg^{27}$ and $F^{19}(n,p)O^{19}$. From these experiments the ratio of $\phi_{epi}/\phi_{fiss} = 0.045 \pm 0.010$ is determined at the activation position. The half-life of Au^{197m} was determined to 7.35 ± 0.25 sec. (auth)

28238 (AEEW-M-304) ERIC I. A FORTRAN PROGRAMME FOR CALCULATING RESONANCE INTEGRALS AND SOME EXAMPLES OF ITS USE. H. M. Sumner (United Kingdom Atomic Energy Authority. Reactor Group. Atomic Energy Establishment, Winfrith, Dorset, England). Apr. 1963. 59p.

The derivation of the formulas, programmed in ERIC 1, for calculating effective resonance integrals for the resolved resonances of non-fissile nuclides, is given. The λ-method, an improvement on the conventional NR and IM energy approximations, is described; and a comparison is made of the two methods for U^{238} metal fuel. Values of λ appropriate to oxygen and uranium in a uranium-oxide fueled system are given. The calculated values of the resonance integral are fitted to $a + b\sqrt{\sigma_{ex}}$, where σ_{ex} is proportional to rod size. Details of input data are given in an appendix. (auth)

28239 (ANL-6718) FORTRAN PROGRAMS FOR COMPUTING ANGULAR DISTRIBUTIONS AND Q VALUES OF NUCLEAR REACTIONS. H. W. Broek (Argonne National Lab., Ill.). May 2, 1963. Contract W-31-109-eng-38. 42p.

Three Fortran programs, written for the IBM-704 computer, process the data from multichannel pulse-height analyzers in order to derive the Q values and differential cross sections of the groups observed. The standard deviations of the derived Q values and of the differential cross sections are also computed. With another program that was written, the effects of impurities can be subtracted from pulse-height spectra observed when a target contains a mixture of nuclides. A fifth program computes the center-of-mass transformation quantities by means of the exact relativistic equations. (auth)

28240 (BNL-400(Vols.I and II)) ANGULAR DISTRIBUTIONS IN NEUTRON-INDUCED REACTIONS. VOLUME I. Z = 1 TO 22. VOLUME II. Z = 23 TO 94. Murrey D. Goldberg, Victoria M. May, and John R. Stehn (Brookhaven National Lab., Upton, N. Y.). Oct. 1962. Contract AT-30-2-GEN-16. 804p.

These volumes are issued separately, but are cataloged as a unit.

Angular distributions of neutrons and of other products

of fast neutron reactions with nuclei are included. Distributions for neutron elastic scattering predominate, but distributions for inelastic scattering and products associated with it are also included. Information for the various elements is arranged in order of their atomic number. The compilation encompasses data available in October 1962 and forms two volumes: z = 1 to 22 and z = 23 to 94. (D.C.W.)

28241 (JINR-P-1258) PERIOD POLURASPADA SPONTANNO DELYASHEGOSYA IZOMERA. (The Half-Life of a Spontaneously Fissionable Isomer). V. P. Perelygin and S. P. Tret'yakova (Joint Inst. for Nuclear Research, Dubna, U.S.S.R. Lab. of Nuclear Reactions). 1963. 7p.

The half-life of a spontaneously fissionable isomer obtained in the reactions of accelerated ions of O^{16}, Ne^{20}, and Ne^{22} with U^{238} was measured. It was found to be (13.5 ± 1.2) msec. The fission fragments were recorded by using nuclear emulsions. From a comparison of all the measured half-lifes a conclusion was drawn that in all these reactions one and the same isomer was observed. (auth)

28242 (JINR-P-1259) O TOCHNOSTI METODA u, v, LREOBRAZOVANIYA. (On the Accuracy of the u, v Transformation Method). I. N. Mikhailov (Joint Inst. for Nuclear Research, Dubna, U.S.S.R. Lab. of Theoretical Physics). 1963. 12p.

A simple method is suggested for reducing the errors in any non-conserving approximation to the solution of the Schrödinger equation, that is in the approximation in which some of the conservation laws are not fulfilled. The integral representation of the projection operators that project an arbitrary function on the space of functions with fixed value of quantum number corresponding to the conservation law are used. This method can be applied to improve the results of the u-v transformation method of the superconductive model of a nucleus and to improve the calculations of the moment of inertia of nuclei. The accuracy of the u-v transformation method is studied. It is shown that it gives the values of the excitation energies of a few lowest states with the accuracy better than 15%. It is also shown that the calculations with the aid of our method reduce the variations of the correlation function C for different excited states of a system. (auth)

28243 (KAPL-M-RPC-6) SWAK, A THERMAL CROSS SECTION PROGRAM. F. D. Federighi and T. J. Reno, Jr. (Knolls Atomic Power Lab., Schenectady, N. Y.). Mar. 15, 1963. Contract W-31-109-eng-52. 47p.

The computer program, SWAK, for computing thermal spectra, one-group group constants, and microscopic cross sections for the energy range 0 to 0.625 Mev is described. The flux spectrum is calculated on the basis of any arbitrary scattering kernel in the library. The energy dependent cross sections of one region can be averaged over the spectrum of another region, and blackness theory effective cross sections can also be calculated. Theory, calculations, options, inputs, and the SWAK library are discussed. (auth)

28244 (KAPL-M-SW-2) NEUTRON ABSORPTION RATES IN LUMPED POISONS. An Experimental Study. S. Weinstein and R. A. Reiter (Knolls Atomic Power Lab., Schenectady, N. Y.). Jan. 4, 1963. Contract W-31-109-eng-52. 50p.

Experiments to measure boron absorption rates relative to U^{235} fission rates in various geometrical configurations are described. Boron absorptions were measured using the sodium spiking technique. Flux shapes in the neighborhood of the material discontinuities are presented graphically. (auth)

28245 (KFK-120) NEUTRON CROSS SECTIONS FOR FAST REACTOR MATERIALS. PART II. TABLES. J. J. Schmidt (Kernforschungszentrum. Institut fur Neutronenphysik und Reaktortechnik, Karlsruhe, Germany). Dec. 1962. 431p. (EANDC-E-35U)

Neutron cross sections and neutron nuclear data tabulated as functions of the neutron incident energy and of the corresponding lethargy in the energy range of 0.01 to 10 Mev are given for H, He, C, O, Na, Cr, Fe, Ni, Mo, U^{235}, U^{238}, and Pu^{239}. Data on fission are presented along with cross sections for neutron scattering, reactions, capture, etc. (D.C.W.)

28246 (NDA-Memo-2123-1) INCLUSION OF SPLITTING AS A FUNCTION OF ENERGY, PHOTONEUTRON PRODUCTION AND VARIANCE CALCULATION IN PROGRAM 18-0 (MONSTER). G. Rabinowitz (Nuclear Development Corp. of America, White Plains, N. Y.). Apr. 18, 1960. For General Electric Co. Aircraft Nuclear Propulsion Dept., Cincinnati. Contract AT(30-1)-2303, Subcontract AT-121. 40p.

A description of, and detailed flow charts for, the changes and additions necessary to incorporate photoneutron production, energy splitting, and computation of variance into the MONSTER program are given. A glossary of new symbols and symbols whose definitions are different from those previously given is included, and the program is described. (auth)

28247 (TID-18788) NUCLEAR CHEMISTRY RESEARCH OF HIGH-ENERGY NUCLEAR REACTIONS AT CARNEGIE INSTITUTE OF TECHNOLOGY, 1962–1963. Annual Progress Report. (Carnegie Inst. of Tech., Pittsburgh). June 1, 1963. Contract AT(30-1)-2897. 49p.

A 2π-differential recoil study of the $Cu^{65}(p,pn)Cu^{64}$ reaction was made to circumvent problems associated with velocity vector diagrams for such reactions. An integral angular distribution study of the reaction was also performed. Kinetic energies obtained for the Cu^{64} nuclei agree well with those expected for an evaporation mechanism (lower kinetic energies) and a knock-on mechanism (higher kinetic energies). As part of a study of the (p,n) reaction mechanism, the excitation functions for the reactions $Sc^{45}(p,n)Ti^{45}$, $Ni^{64}(p,n)Cu^{64}$, $Rh^{103}(p,n)Pd^{103}$, $Te^{103}(p,n)I^{130}$, and $W^{186}(p,n)Re^{186}$ were determined. An exponential dependency of the cross sections on target mass is indicated. Integral recoil measurements were made on the $Ni^{64}(p,n)Cu^{64}$, $Rh^{103}(p,n)Pd^{103}$, and $W^{186}(p,n)Re^{186}$ systems. Previously obtained results for the Ni^{64} reaction were found to be erroneous. Good results were obtained by analytical determination of the $Ni^{64}(p,n)Cu^{64}$ cross section. Analysis of the (p,n) recoil experiments showed the same reaction to have a forward-backward recoil ratio of about 4:1; other systems analyzed had ratios as high as 2:1. The $Ni^{64}(p,n)Cu^{64}$ angular distribution was calculated; the results indicate that the (p,n) reaction may be confined to upper neutron levels. Preliminary experiments were made to determine the mass dependence of the formation cross sections for Na^{24}. Cross sections for $As^{75}(p,pn)As^{74}$ reactions at 130 to 250 Mev were determined, and the excitation function of the $W^{186}(p,2p)Ta^{185}$ reaction was redetermined. The half lives of Y^{82}, Y^{83}, and Y^{85} were determined to be 12 ± 3 min, 10 ± 2 min, and 2.3 ± 0.2 hr. A literature survey on (N,2N) reactions was initiated. (D.C.W.)

28248 (TID-18899) THE MÖSSBAUER CROSS SECTION FOR IRON-57 AT ROOM TEMPERATURE. William

Denno (Argonne National Lab., Ill.). Feb. 1963. Contract W-31-109-eng-38. 22p. (UAC-7331).

Mössbauer spectra for Fe^{57} were accumulated for five different values of foil thickness. The Mössbauer cross section was determined by an area ratio method. It was found that the results are inconsistent with the reported values of the internal-conversion coefficient for Fe^{57}. (auth)

28249 (UCOL-P-518) THE LEVEL STRUCTURE OF Sc^{44}. J. K. Kliwer, J. J. Kraushaar, R. A. Ristinen, J. R. Keith, and A. A. Bartlett (Colorado. Univ., Boulder). [1962]. Contract AT(11-1)-535. 37p.

The nuclear level structure of Sc^{44} was studied through the decay of Ti^{44} and Sc^{44m} (2.4 day). Transitions were observed in the decay of Ti^{44} with energies of 67.85 and 78.44 kev, and the measured conversion coefficients indicate that they are both predominantly M1. The half life of the first excited state was determined to be 166 ± 5 nsec. Directional correlation measurements indicate that the spin of the first excited state is either 2 or possibly 1 and that the second excited state has a spin of 1. (29 references) (auth)

28250 (UCRL-10512) THE HALF-LIFE OF FLUORINE-18. John D. Mahony and Samuel S. Markowitz (California. Univ., Berkeley and California. Univ., Berkeley. Lawrence Radiation Lab.). Oct. 18, 1962. Contract W-7405-eng-48. 10p.

Radiochemically pure F^{18} was prepared by three different methods, and its decay was followed with β proportional counters and γ-ray counters in an effort to measure the half life accurately. Analysis by a computer program that used the method of least squares gave a weighted mean half life of F^{18} and a weighted standard deviation of the mean as 109.74 ± 0.21 minutes. (auth)

28251 (UCRL-10689) NEUTRON SPECTRA FROM HEAVY-ION BOMBARDMENT OF GOLD. William G. Simon (California. Univ., Berkeley. Lawrence Radiation Lab.). Apr. 12, 1963. Contract W-7405-eng-48. 21p.

Neutron yields from bombardment of a thick Au target by 164- and 142-Mev O^{16} ions were measured. Neutrons were detected by means of nuclear emulsions at 15-deg intervals from 0 to 165°. The yields at 164 and 142 Mev are subtracted to obtain average cross sections over this energy interval that are then transformed to the center-of-mass system. The anisotropy coefficient a, defined by the expression $W(\theta) = 1 + a \cos^2 \theta$, is about 1 for 2-Mev neutrons and decreases rapidly with energy. The distribution of neutrons is essentially isotropic above 6 Mev. This behavior disagrees with calculations of the angular distribution of neutrons from fission fragments, which are based on the fragment angular distribution measured by Viola. It is concluded that some neutrons are emitted from the system before fission occurs. (auth)

28252 (UCRL-10693) EMISSION OF CHARGED PARTICLES IN HEAVY ION INTERACTIONS. Donald V. Reames (California. Univ., Berkeley. Lawrence Radiation Lab.). Apr. 12, 1963. Contract W-7405-eng-48. 17p.

The energy spectra of light charged particles produced at 0° in the reactions of 167-Mev O^{16} ions with Al, Ni, Ag, and Au thick targets were obtained by magnetic analysis. Using nuclear emulsions as a detector, it was possible to resolve protons, deuterons, tritons, He^{3}'s, α particles, Li^{6}'s, Li^{7}'s, and Li^{8}'s. Yields were measured down to $\approx 10^{-11}$ per Mev per steradian. These yields are compared with calculations based on multiple emission from a compound nucleus, and effects attributable to direct interaction processes are in evidence. (auth)

28253 (UCRL-10741) CHARGE DISTRIBUTIONS OF PRODUCTS OF REACTIONS BETWEEN COMPLEX NUCLEI. Naftali H. Steiger (California. Univ., Berkeley. Lawrence Radiation Lab.). Apr. 5, 1963. Contract W-7405-eng-48. 32p.

The effective charge-state distributions of products produced in several heavy-ion-induced reactions that have Dy^{149}, Tb^{149}, and Ho^{149} as their primary spallation products were investigated. Experimental analysis, apparatus, and procedure are described; and the results are presented and discussed. (D.C.W.)

28254 (UCRL-10752(Suppl.)) ANISOTROPY FACTORS FOR THE DETERMINATION OF TOTAL NEUTRON YIELD FROM THE D(d,n)He^3 AND T(d,n)He^4 REACTIONS. Lawrence Ruby and Richard B. Crawford (California. Univ., Berkeley. Lawrence Radiation Lab.). Apr. 9, 1963. Contract W-7405-eng-48. 14p.

Tables of the anisotropy factor, R, which is useful in determining, by the associated particle method, the total neutron yield produced in the reactions T(d,n)He^4 and D(d,n)He^3 were computed. The range of incident deuteron energy covered is 25 to 500 kev, at associated particle colatitude angles of 90 to 180 deg. Thick-and thin-target cases were treated. For the T(d,n)He^4 reaction, the total neutrons produced per alpha particle incident on the detector is given by the relation, $N = (4\pi/\Delta\Omega)R$. In the case of the D(d,n)He^3 reaction, it is more convenient to detect the protons produced in the competing reaction D(d,p)T. The total neutrons per proton incident on the detector is then given by $N = (4\pi/\Delta\Omega)R\ (Y_{d,n}/Y_{d,p})$, where $(Y_{d,n}/Y_{d,p})$ is the ratio of total neutrons to total protons produced. Tables of this ratio, of R, and of their product are given. (auth)

28255 (UCRL-10764) METASTABLE STATES IN THE LIGHT THALLIUM ISOTOPES PRODUCED IN HEAVY-ION REACTIONS. R. M. Diamond and F. S. Stephens (California. Univ., Berkeley. Lawrence Radiation Lab.). Apr. 1963. Contract W-7405-eng-48. 17p.

The relatively short-lived isomeric states produced in the odd-mass thallium isotopes were studied by irradiating suitable targets with heavy ions ranging from He^4 to Ne^{20} to produce excited thallium nuclei of mass 191 to 200. Transitions were observed with electron and gamma spectrometers. Energies, half lives, intensities, and mass assignments were determined for the electron lines. Multipole assignments were made from the experimental K/L electron ratios. The half lives of states and the half lives, intensities and types (E2, etc.) of transitions were determined. Assignments were also made for the spin of ground and lower excited states, and the proposed level schemes for isomeric Tl^{199}, Tl^{197}, Tl^{195}, and Tl^{193} are given. The isomeric levels in Tl^{199} and Tl^{193} were assigned a spin of $9/2$ as were corresponding levels in Tl^{197} and Tl^{195} that were previously assigned as $h_{9/2}$ single particle states. (D.C.W.)

28256 (UCRL-10766) TOTAL REACTION CROSS SECTIONS FOR HEAVY IONS. Bruce Wilkins and George Igo (California. Univ., Berkeley. Lawrence Radiation Lab.). Apr. 1963. Contract W-7405-eng-48. 14p.

The total reaction cross sections for 150 Mev oxygen-16 ions and 114 Mev carbon-12 ions on the elements Be, C, Al, Fe, Ni, Cu, Ag, Sn, Ta, and Au were measured. The energy dependence of total reaction cross section for oxygen-16 on Al and Ag and carbon-12 on Al was investigated. A beam attenuation technique utilizing mμsec electronics was used to make these measurements. (N.W.R.)

28257 (UCRL-10772) TERNARY FISSION OF HEAVY COMPOUND NUCLEI. P. B. Price, R. L. Fleischer, and

R. M. Walker (General Electric Co. Research Lab., Schenectady, N. Y. and California. Univ., Berkeley. Lawrence Radiation Lab.). Apr. 1963. Contract W-7405-eng-48. 11p.

An attempt was made to observe the ternary fission that is expected from the charged liquid drop model for nuclei with large Z^2/A. Pb and U were loaded into glass and mica and bombarded with 414-Mev Ar ions. Cf^{252} was sandwiched between layers of mica, and its spontaneous fission tracks were observed. The glass and mica registered fission fragment tracks, but not the Ar ion tracks. Both two- and three-pronged events were observed, and an analysis of the Ar + Pb data (the most plentiful) indicated that ternary fission of this compound nucleus occurs with a higher frequency than was previously reported for other nuclei. (D.C.W.)

28258 (UCRL-10775) EQUILIBRIUM SHAPES OF A ROTATING CHARGED DROP AND CONSEQUENCES FOR HEAVY-ION-INDUCED NUCLEAR REACTIONS. S. Cohen (Argonne National Lab., Ill.); F. Plasil, and W. J. Swiatecki (California. Univ., Berkeley. Lawrence Radiation Lab.). Apr. 29, 1963. Contract W-7405-eng-48. 20p.

Equilibrium configurations of an idealized charged rotating drop were studied by using an electronic computer. The symmetric families of saddle-point shapes, and two families of stable equilibrium shapes (flat shapes and cylinders) were traced as functions of the fissionability parameter x, and of the amount of rotational energy for all nuclei in the periodic table with any angular momentum. It was found that in the case of heavy nuclei ($x \geq 0.7$), rotation distorts the spherical nucleus into a flat shape (rotating about its axis of symmetry) and that further rotation results in instability against fission. For $x \leq 0.7$, as rotation increases, the flat shape first undergoes a transition to a cylinder-like shape before becoming unstable against fission. The results are illustrated by means of impact parameter versus bombarding energy diagrams for the case of Ne^{20} ions reacting with Al^{27}, Pr^{141}, and U^{238}. Expected regions of formation of stable cylindrical shapes and of breakup due to large angular momentum are shown. It was found that relatively favorable conditions for forming a stable cylindrical shape exist for very light targets, and that breakup reactions caused by large angular momentum become important for heavy targets. Variations of the fission threshold with the amount of rotational energy for different values of x is given. The fission threshold is found to decrease rapidly with increasing rotation. (auth)

28259 (UCRL-10825) INELASTIC SCATTERING OF 166-Mev O^{16} IONS BY Ta^{181}. A. Isoya, H. E. Conzett, E. Hadjimichael, and E. Shield (California. Univ., Berkeley. Lawrence Radiation Lab.). May 1961. Contract W-7405-eng-48. 18p.

Observation of coincidences between the scattered ions and the de-excitation γ-rays from the lowest excited states in inelastic scattering of 166-Mev O^{16} ions to the lowest excited states of Ta^{181} permitted separation of elastic and inelastic events. The results showed that Coulomb excitation of unresolved low-lying states contributed up to 8% to elastic differential cross sections for 166-Mev O^{16} ions on Ta^{181} in the angular region before the sharp drop to Rutherford values. At backward angles, the contribution was as high as 28%. The correction calculated by Coulomb excitation theory can apparently be used for the essential correction of heavy ion elastic scattering data. (D.C.W.)

28260 (USNRDL-TR-642) ESTIMATES OF FISSION PRODUCT YIELDS OF A THERMONUCLEAR EXPLOSION. G. R. Crocker (Naval Radiological Defense Lab., San Francisco). Apr. 4, 1963. Contract AT(49-7)-1963. 21p.

Chain yields and independent yields of the U^{238} fission products from a thermonuclear explosion were estimated. Since unclassified data for this kind of process are scanty, some features of the mass yield curve were inferred from published data on U^{238} fission by neutrons ranging from fission-spectrum energies to 14 Mev. Independent yields of the fission products were then calculated by application of the equal charge displacement (ECD) theory of nuclear charge distribution in fission processes. (auth)

28261 ON MODEL CALCULATIONS OF NEUTRON WIDTHS AND STRENGTH FUNCTIONS. Carl Shakin (Massachusetts Inst. of Tech., Cambridge). Ann. Phys. (N. Y.), 22: 373-405 (June 1963). (TID-18476)

A procedure for calculating the neutron strength function is considered. Methods are developed that relate the calculation of the strength function to the usual concepts of the shell model and nuclear optical model. Specific consideration is given to the isotopes of lead and tin and the agreement with experiment is good. Further, it is also shown that the neutron widths calculated for very simple excitations can be quite small for heavy nuclei due to cancellations that appear in a certain overlap integral. This result implies that the observation of a resonance of very small width does not necessarily imply the formation of a compound state of great complexity. The simple excitations considered are a reasonable approximation to the virtual states of a compound nucleus such as Pb^{209}, and in this case, the calculated widths agree in order of magnitude with the widths found experimentally. (auth)

28262 THE DEFORMATION ENERGY OF A CHARGED DROP. PART V. RESULTS OF ELECTRONIC COMPUTER STUDIES. Stanley Cohen (Argonne National Lab., Ill.) and Wladyslaw J. Swiatecki. Ann. Phys. (N. Y.), 22: 406-37 (June 1963). (UCRL-10450)

The results of electronic computer studies of equilibrium configurations of an idealized charged drop are presented. The symmetric family of saddle-point shapes was traced as a function of the fissionability parameter x. The properties of the saddle-point shapes were tabulated in the interval $x = 0.30$ to 1.00 in steps of 0.02. The appearance of these shapes changes from dumbbell-like for $x \lesssim 0.67$ to cylinder-like for $x \gtrsim 0.67$. The transition is fairly rapid, but not discontinuous. The properties tabulated include the energies, moments of inertia, and quadrupole moments of the saddle-point shapes. In addition, the elastic constants of the symmetric saddle-point shapes for different types of symmetric and asymmetric distortions were determined. The shapes were found to be stable against asymmetry down to $x = 0.39$, at which point an asymmetric family of equilibrium shapes bifurcates. A simple formula is given that reproduces the calculated liquid-drop thresholds with fair accuracy. (auth)

28263 K^--DEUTERIUM INTERACTIONS. Ramesh Chand (Univ. of Chicago). Ann. Phys. (N. Y.), 22: 438-80 (June 1963). (EFINS-62-59)

Expressions for differential cross sections for elastic scattering, charge-exchange scattering, scattering with deuteron disintegration, and of the total cross sections for certain absorptive processes involving hyperon production are given for K^--d collisions as functions of incident K^--momentum. These were obtained using the zero-range boundary condition method of Dalitz and Tuan for the representation of the $\bar{K}N$ interaction and of its extension by Dalitz to include the πY channels, and include the multiple scattering effects in the initial $\bar{K}NN$ state. Illustrative cal-

culations of these cross sections are given for the $\bar{K}N$ scattering amplitudes given by Ross and Humphrey and by Watson. Tolerable agreement with the rather limited data on K^--d cross sections between 100 and 300 Mev/c is obtained for a reasonable interpolation between these amplitudes as function of momentum. (auth)

28264 THEORETICAL STUDY OF THE EXCITED LEVELS OF C^{12} AND OF 0^+ LEVELS OF O^{16}: APPLICATION TO THE INELASTIC SCATTERING OF 155-Mev PROTONS BY C^{12}. Nicole Vinh Mau (Faculté des Sciences, Paris). Ann. Phys. (Paris) (13), 8: 1-39(Jan.-Feb. 1963). (In French)

The excited states of the C^{12} nucleus were studied using a model based on simple excitations of a single particle. Two different approximations were envisaged. The first, assuming that the ground state is consituted of non-interacting particles, reduces the problem to the diagonalization of the nucleon-nucleon interaction in a limited subspace of hole-particle configurations. The second, taking correlations between nucleons in the ground state of the nucleus into consideration, is equivalent to the quasi-boson method. A nucleon-nucleon interaction with zero range and a gaussian-type interaction with exchange forces were studied. In these two cases and in the second approximation, the experimental spectrum of C^{12} could be reproduced very satisfactorily and some experimentally unknown levels could be indicated. The 1^+ and 2^+ levels are in the least good accord with experiment. The importance of two-particle excitations in the particular case of 0^+ levels of O^{16}, which is very poorly described by the preceding model, was studied. The results are quite satisfactory and show that the introduction of two-particle excitations is necessary to describe the experimental 0^+ level at 6.06 Mev. The wave functions of excited states of C^{12} were used to calculate inelastic scattering cross sections for $p + C^{12} \rightarrow p' + C^{12}$ for 155-Mev protons. The recent experimental results obtained at Orsay are theoretically interpreted. (tr-auth)

28265 YIELDS AND ANGULAR DISTRIBUTIONS OF FAST PHOTOPROTONS. O. M. Mracek Mitchell and K. G. McNeill (Univ. of Toronto). Can. J. Phys., 41: 871-80 (June 1963).

Measurements are described on the angular distributions of fast photoprotons ($E_p > 8$ Mev) ejected from 16 elements of $13 \leq Z \leq 50$ by a bremsstrahlung spectrum of 22-Mev maximum energy. Some shell features are observed which, together with results of others, are discussed in terms of the Wilkinson model of photodisintegration. (auth)

28266 THE SPIN OF THE 3.70-Mev LEVEL IN Al^{25}. G. J. McCallum (Inst. of Nuclear Sciences, Lower Hutt, N. Z.). Can. J. Phys., 41: 923-31(June 1963).

The 3.70-Mev level in Al^{25} was studied by means of the reaction $Mg^{24}(p,\gamma)Al^{25}$ at the 1.49-Mev resonance. Direct angular distribution measurements of the de-excitation gamma radiation support the spin assignment of $7/2^-$ for this level. An E2/M1 amplitude mixing ratio of -0.55 ± 0.2 is found for the 1.79-Mev de-excitation radiation from the fourth excited state to the ground state of Al^{25}. The ratio of the reduced transition probability of the E2 radiation from the 1.79-Mev level to the first excited state is shown to be ~30 times that to the ground state. This result provides further confirmation of rotational band structure in Al^{25} since the collective model predicts such an enhancement of E2 transitions between rotational bands whereas cross-band transitions are not expected to be enhanced. (auth)

28267 THE DECAY OF Ba^{133}. K. C. Mann and R. P. Chaturvedi (Univ. of British Columbia, Vancouver). Can. J. Phys., 41: 932-45(June 1963).

The electron-capture decay of Ba^{133} and the subsequent de-excitation of Cs^{133} were investigated with magnetic and scintillation spectrometers. The measured conversion coefficients and transition intensities lead to the spin assignments for the states of Cs^{133}. The multipolarities of the connecting transitions are given. The limits of experimental error in the measured conversion coefficients do not exclude the possibility that the 437-kev level is $3/2^+$ and that both the 276 and 356-kev transitions are M1 + E2 admixtures. (auth)

28268 CONTRIBUTION TO THE STUDY OF NUCLEAR SPALLATION REACTIONS. Rui da Silveira (Faculté des Sciences, Orsay, France). Compt. Rend., 256: 4192-4(May 13, 1963). (In French)

The Bi(p,xn)Po reactions were studied. The excitation functions for the formation of four Po isotopes, produced by proton reactions with Bi, were traced. The cross sections obtained agree very well with a calculation based on the direct proton-nucleon interaction, followed by the evaporation of a large number of neutrons. (tr-auth)

28269 SEARCH FOR GAMMA RAYS FOLLOWING THE DECAY OF 3-HOUR Ti^{45}. M. K. Ramaswamy (Karnatak Univ., Dharwar, India). Current Sci. (India), 32: 13-14(Jan. 1963).

Ti^{45} was produced by bombarding pure Sc^{45} with 6-Mev protons. The single γ-ray spectrum observed in a 1" × 2" NaI crystal contained only the annihilation radiation. The γ spectrum coincident with positrons was investigated next employing 2 NaI counters at 90° to each other to minimize annihilation radiation coincidences. The coincidence resolving time was 25 nanosec. The coincidence spectrum showed the presence of a γ ray of 270 ± 10 kev. Since a 90° scattering of the annihilation radiation can produce such a γ ray, a triple coincidence experiment was performed in which γ rays in coincidence with the 2 annihilation quanta were sought. In the range up to 600 kev no γ ray was observed. An upper limit of 0.1% (relative to the ground state decay) could be set on any γ ray produced. The ground state spin of Ti^{45} can be either $3/2$, $5/2$, or $7/2$ with odd parity. An assignment of $7/2$ for this and $3/2$ for the 377-kev level seen in inelastic scattering experiments would explain the absence of any γ rays following Ti^{45} decay. (TCO)

28270 A POSSIBLE REASON FOR THE DIVERGENCE IN RESULTS OBTAINED BY MEASURING EQUILIBRIUM VAPOR PRESSURE RATIOS OF TWO ISOTOPES BY THE DIFFERENTIAL METHOD AND BY RAYLEIGH'S METHOD. I. B. Amirkhanova, A. V. Borisov, I. G. Gverdtsiteli, and R. Ya. Kucherov (Inst. of Technical Physics, Georgian SSR). Dokl. Akad. Nauk SSSR, 149: 351-2(Mar. 11, 1963). (In Russian)

The separation coefficient of a binary isotopic mixture in an equilibrium vapor-liquid system is equal to the ratio of the saturated vapor pressures of the pure isotopes: $\alpha = (p_0)_1/(p_0)_2 = R$. In the case of a $B^{10}F_3$–$B^{11}F_3$ mixture, the enrichment coefficient $\epsilon = \alpha - 1$ decreases with increasing temperature, when the vapor pressure ratio is measured directly on two samples differing in isotopic composition, and increases with increasing temperature, when measured by the Rayleigh distillation method. One explanation is that the rate of evaporation has the following effect on the separation coefficient: $\alpha = R(1 + \delta)$, where the kinetic correction δ is determined by the following formula: $\delta = (2 - a/4)(\tau_p/\tau_D)(m_2 - m_1/m_1)$. Here τ_p

is the experimental rate of evaporation; τ_B is the rate of evaporation in vacuum (the limiting rate of evaporation); $\tau_B = (ap_H/\sqrt{2\pi mkT}$; m_1 and m_2 are the masses of the isotopes; a is the evaporation coefficient; k is the Boltzman constant, and p_H is the saturation vapor pressure at temperature T. If the light isotope is more volatile (for example, methane), the separation coefficient increases, and if the heavy isotope is more voltatile (for example, boron trifluoride), the separation coefficient decreases during nonequilibrium distillation. With the use of values of 4.8×10^{-3} and 3.3×10^{-4} for the evaporation coefficients of BF_3 (170°K) and CH_4 (113.5°K) respectively, the kinetic corrections were calculated for BF_3 and CH_4. The kinetic corrections are of the same order of magnitude as the enrichment coefficients, and they qualitatively explain the isotopic effects observed in the $B^{10}F_3 - B^{11}F_3$, and $C^{12}H_4 - C^{13}H_4$ systems. (TTT).

28271 THE PREPARATION OF CARRIER-FREE SULFUR-35. Hsi-jung (Si-jung) Yeh (National Tsing-hua Univ., China). Ho Tzu K'o Hsueh, 3: No. 4, 25-31(Sept. 1962). (In English)

A procedure for the preparation of S^{35}, based on the nuclear reaction of $Cl^{35}(n,p)S^{35}$, is described. Purified KCl was selected to be the target material and was irradiated at a thermal neutron flux of 10^{10} n/cm^2/sec for 30 hr over a period of 5 to 6 days. The S^{35} was then separated by means of an ion-exchange method after a week. Chemical analysis showed that the purity of S^{35} (containing 0.02% P^{32}) was in accord with the international standards. It was concluded that the Tsing-hua Reactor can be used to mass produce S^{35}. (OID)

28272 THE PREPARATION OF CARRIER-FREE PHOSPHORUS-32 BY NEUTRON IRRADIATION. Hsi-jung (Si-jung) Yeh (National Tsing-hua Univ., China). Ho Tzu K'o Hsueh, 3: No. 4, 33-7(Sept. 1962). (In English)

Preliminary results on a possible large scale P^{32} production method are described. The target material was S that was purified by sublimation at least 4 times. It was then irradiated at a thermal neutron flux of 10^{10} n/cm^2/sec for 30 hr over a period of 5 to 6 days. The P^{32} separation was carried out several days later and it was found best to use the dry distillation method. Analysis was made by paper chromatography. Part of the S^{35} present was removed by an anion exchange column. The P^{32} thus prepared, however, still contained up to 0.1% of S^{35} and needed to be purified further. (OID)

28273 ON NUCLEAR BINDING ENERGY. A. K. Dutta (University Coll. of Science, Calcutta). Indian J. Phys., 37: 183-4(Mar. 1963).

A formula with slight adjustments of the maximum binding energy and the corresponding mass number to obtain a closer fit with the large amount of binding energy data is presented. The relation obtains the binding energies of all 1600 nuclei, from carbon-6 to fermium-100, with an average fluctuation of less than ±3 Mev, for any mass number. A few nuclei obtain deviations of the order of ±10 Mev. (C.E.S.)

28274 OBSERVATION OF 'HAMMER' STARS CAUSED BY Li^9 DECAY. G. C. Deka and K. M. Pathak (Cotton Coll., Gauhati, India). Indian J. Phys., 37: 145-50(Mar. 1963).

In a systematic area scanning of emulsion pellicles irradiated with the separated beam of 4.6 Bev/c negative pions, 290 double stars — so-called hammer stars — were observed and carefully measured. It is seen that 35 of these events have features that distinguish them from the ordinary hammer tracks usually caused by Li^8-decay. From their kinematical analyses, these 35 events can be interpreted as due to the radioactive decays of the Li^9 nuclei. Also the energy levels of Be^9 can be calculated from their analyses. (auth)

28275 Z-DEPENDENCE OF PAIR CROSS-SECTION IN THE ENERGY REGION 1 TO 2 Mev. J. Rama Rao, V. Lakshminarayana, and Jnanananda Swami (Andhra Univ., Waltair, India). Indian J. Pure Appl. Phys., 1: No. 6, 199-207(June 1963).

Absolute pair cross sections in copper, zirconium, rhodium, tin, tantalum, platinum, gold, and lead for gamma rays in the energy region 1 to 2 Mev are determined with a coincidence scintillation spectrometer, using intense sources of scandium-46, cobalt-60, europium-(152 + 154) and antimony-124. The experimental values of pair cross sections (σ) show progressively increasing deviation from Bethe-Heitler values (σ_{BH}) towards lower energies, according to expectation. In the case of lead, the experimental value obtained with antimony-124 source agrees with the interpolated value from J. C. Jaeger and H. R. Hulme's exact data at 3 mc^2 and 5.2 mc^2. The extrapolated values from Jaeger and Hulme's data are found to be higher than the experimental values in lead obtained with europium-(152 + 154), cobalt-60, and scandium-46 sources. This discrepancy is attributed to the error involved in the process of extrapolation. The values of pair cross-sections in all the elements obtained in the study are found to show general agreement with previous results wherever such comparison could be made. The Z-dependence of pair cross section in the energy region 1.33–2.00 Mev could be represented by an equation of the type $\sigma = \sigma_{BH}(1 + dZ^2)$ with the deviation parameter d progressively increasing in value towards the low energy limit. However, at 1.119 Mev, the experimental data could be fitted in a modified Z-dependence formula. (auth)

28276 NEUTRON SCATTERING BY MAGNESIUM AT 14 Mev. V. V. Bobyr, L. Ya. Grona, and V. I. Strizhak (Kiev State Univ.). Izv. Vysshikh Uchebn. Zavedenii, Fiz., No. 2, 111-13(1963). (In Russian)

Differential cross sections for 14-Mev elastic and inelastic scattering by magnesium were measured in ring geometry using T(d,n) neutrons. Scattered neutron, background, and straight beam spectra were measured for each scattering angle. (tr-auth)

28277 THE RATIO OF THERMAL NEUTRON CAPTURE TO FISSION FOR ^{239}Pu. M. J. Cabell and L. J. Slee (Atomic Energy Research Establishment, Harwell, Berks, Eng.). J. Inorg. Nucl. Chem., 25: 607-14(June 1963). (AERE-R-4173).

Alpha, the ratio of neutron capture to fission, for Pu^{239} was measured at seven different points along a flux scanning tube of the PLUTO reactor. Highly-enriched Pu^{240} samples were also irradiated to make allowance for the destruction of this nuclide. Experimental values of α for Pu^{239} varied from 0.458 to 0.470. Correcting all results to 2200 m/sec neutrons gave a mean value for α_0 of 0.370 ± 0.008, a result that is in excellent agreement with present recommended values, but does not include uncertainties in the g and s values for neutron capture and fission. (auth)

28278 THE PILE NEUTRON FISSION YIELDS OF ^{127}Sb AND ^{129}Sb. E. Hageboe (Uppsala Univ.). J. Inorg. Nucl. Chem., 25: 615-17(June 1963).

The fission yield of Sb^{129} was determined relative to Sb^{127} by counting their respective daughters Te^{129g} and Te^{127g}. Samples of $UO_2(NO_3)_2 \cdot 6H_2O$ were used for the neu-

tron fission process. The fission yield of Sb^{129} was calculated to be 1.12%, which is much higher than previous determinations. The measured yield of Sb^{127}, 0.14%, agrees well with other determinations. (C.E.S.)

28279 FAST NEUTRON CAPTURE IN ^{232}Th. D. C. Stupegia (Argonne National Lab., Ill.), B. Smith, and K. Hamm. J. Inorg. Nucl. Chem., 25: 627-30(June 1963). (TID-17651)

The capture cross section of Th^{232} was determined for monoenergetic neutrons in the energy range 0.19–1.1 Mev. The shape of the curve agrees closely with the theoretical curve predicted by Lane and Lynn, showing a definite rise in cross section with increasing energy near 0.8 Mev. (auth)

28280 RELATIVE YIELDS OF ^{111}Pd AND ^{111m}Pd IN THE DECAY OF ^{111}Rh. M. V. Ramaniah, K. Rengan, and N. Ravindran (Atomic Energy Establishment, Trombay, India). J. Inorg. Nucl. Chem., 25: 725-6(June 1963).

The ratio of cumulative yields of Pd^{111} and Pd^{111m} was determined in neutron fission of natural uranium to give an indication of the branching ratio in the decay of the short-lived parent, Rh^{111}. The ratio was obtained by determining separately the Ag^{111} due to both Pd^{111} and Pd^{111m} together, and the Ag^{111} due to Pd^{111m} alone, taking advantage of the large difference in the half lives of the two isomers. A branching ratio of '19 ± 7 was obtained. (C.E.S.)

28281 ON THE DECAY OF ^{72}Zn. P. del Marmol and P. F. Fettweis (Centre d'Etude de l'Energie Nucleaire, Mol, Belg.). J. Inorg. Nucl. Chem., 25: 741-2(June 1963).

Information on the β and γ rays present in the decay of Zn^{72} was presented. The γ spectrum was recorded and peaks at 147 ± 2 and 194 ± 2 kev were observed. The intensity of the 194-kev peak was 10 ± 0.5% of the 147-kev peak. No coincidences between these γ rays were found. A Curie plot of the β spectrum showed a β ray of 0.26 ± 0.02 Mev maximum energy. No clear conclusions on the transitional probabilities could be drawn from the experiment. (C.E.S.)

28282 STATISTICAL THEORY OF THE ENERGY LEVELS OF COMPLEX SYSTEMS. [PART] IV. Freeman J. Dyson and Madan Lal Mehta (Inst. for Advanced Study, Princeton, N. J.). J. Math. Phys. (N. Y.), 4: 701-12(May 1963).

A theory was previously constructed for the description of the statistical properties of the eigenvalues of a random matrix of high order. From the same theoretical model, the statistical behavior to be expected for a finite stretch of observed eigenvalues chosen out of a much longer stretch of unobserved ones is derived. In comparing the model with experimental data, a finite stretch of observed levels is always considered. Three "statistics" are investigated; these are quantities that can be computed directly from the observed data, and for which the expectation values and statistical variances can be calculated from the theory. One statistic gives only a precise way of measuring the average level spacing. One provides a test of the model by measuring the degree of long-range order in the level series. The third provides an independent test of the model by measuring the degree of short-range order. These methods are applied to a preliminary analysis of some experimental data on neutron capture levels in heavy nuclei. The results are inconclusive. Discrepancies between theory and observation are large, but the discrepancies might be produced either by incompleteness of the data or by incorrectness of the theoretical model. (auth)

28283 STATISTICAL THEORY OF THE ENERGY LEVELS OF COMPLEX SYSTEMS. [PART] V. Madan Lal Mehta and Freeman J. Dyson (Inst. for Advanced Study, Princeton, N. J.). J. Math. Phys. (N. Y.), 4: 713-19(May 1963).

An identity that establishes an intimate connection between the statistical behavior of eigenvalues of random unitary matrices over the real field and over the quaternion field is proved. It is proved that the joint distribution function of all the eigenvalues of a random unitary self-dual quaternion matrix of order N is identical with the joint distribution function of a set of N alternate eigenvalues of a random unitary symmetric matrix of order 2N. A corollary of this result is the following: the distribution of spacings between next-nearest-neighbor eigenvalues in a real symmetric matrix of large order is identical with the distribution of nearest-neighbor spacings in a self-dual Hermitian quaternion matrix of large order. A conjecture is made which gives an exact analytic formula for the partition function of a finite gas of N point charges free to move on an infinite straight line under the influence of an external harmonic potential. This conjecture is at the same time a statement about the statistical properties of the eigenvalues of Hermitian matrices whose elements are Gaussian random variables. A list is made of several other problems that remain unsolved in the statistical theory of eigenvalues of random matrices. (auth)

28284 HYPERFINE STRUCTURES, ISOTOPE SHIFTS, AND NUCLEAR MOMENTS OF Hg^{195}, Hg^{195m}, AND Hg^{194}. Herbert Kleiman and Sumner P. Davis (Univ. of California, Berkeley). J. Opt. Soc. Am., 53: 822-7(July 1963).

The hyperfine structures of five lines in the optical spectra of Hg^{195}, Hg^{195m}, and Hg^{194} were investigated under high resolution. The nuclear moments, calculated from ratios of hyperfine splittings, are $\mu(195^m) = -1.060 \pm 0.01$ nm, $Q(195^m) = 1.5 \pm 1$ b, and $\mu(195) = +0.526 \pm 0.005$ nm. Isotope shifts measured relative to Hg^{196} were found to be $\Delta(195-196) = +77.2 \pm 5$ mK, $\Delta(195^m-196) = +92.6 \pm 5$ mK, and $\Delta(194-196) = +143 \pm 10$ mK. The last result is not in agreement with published measurements. Further investigation is required before a theory can be considered applicable. (auth)

28285 HYPERFINE STRUCTURE, ISOTOPE, AND ISOMER SHIFTS IN Hg^{193m}, Hg^{194}, Hg^{195m}, AND Hg^{195} — COMMENTS ON THE PAPER OF KLEIMAN AND DAVIS. W. J. Tomlinson, III and H. H. Stroke (Massachusetts Inst. of Tech., Cambridge). J. Opt. Soc. Am., 53: 828-30(July 1963).

An analysis was made of the discrepancies between the hfs and isotope shift results for Hg^{194}, Hg^{195}, and Hg^{195m} of Kleiman and Davis and our data, particularly in view of the importance of these results for the interpretation of the odd-even staggering effect in isotope shift. The hfs results were confirmed by the more precise level-crossing experiments of W. W. Smith. Errors in the work of Kleiman and Davis were attributed, in part, to the presence of Hg^{197} and Hg^{197m} in their sources. Experimental results are shown for the Hg^{194} isotope shift. It is found that the $Hg^{194}-Hg^{196}$ isotope shift = 0.146 ± 0.010 cm^{-1}, and a preliminary value $Hg^{193m}-Hg^{195m}$ shift = 0.150 cm^{-1}. These results lend further support to our hypothesis on the causes of odd-even staggering in isotope shift. (auth)

28286 PHOTONEUTRON REACTION OF S^{32}. Naoshi Mutsuro, Kosuke Kageyama, Masanori Mishina, Eiji Tanaka, Teruo Aizawa, and Motoharu Kimura (Tohoku Univ., Sendai). J. Phys. Soc. Japan, 18: 599-609(May 1963). (In English)

The photoneutron cross section of S^{32} was observed up to 22 Mev with good energy resolution, together with the photoneutron spectrum using a stilbene scintillation spectrom-

eter. Fine structures were observed in either of the two measurements. Taking into account the threshold energy and the excitation energies of the residual nucleus, these structures were shown to be consistently related with each other. Experimental results were discussed using the statistical model calculation, assuming that the emitted particles were only p-wave and f-wave particles. The integrated cross section ratio for S^{32} (γ,n) to P^{31} (γ,n) reaction and the same ratio for S^{32} (γ,p) to S^{32} (γ,n) reaction were well explained by the calculations. The difference between the energy spectrum of the photoprotons from P^{31} and that from Si^{28} also seemed to be well explained qualitatively. In the appendix, the contributions of the f-wave protons for the energy spectrum of photoprotons were shown. The photodisintegration of nuclei in these mass number region was concluded to occur mainly through the compound process in the giant resonance energy region. (auth)

28287 STATISTICAL ANALYSIS OF FAST NEUTRON TOTAL CROSS SECTIONS OF SILICON, PHOSPHOR, SULFUR, AND CHLORINE. Kineo Tsukada, and Osamu Tanaka (Japan Atomic Energy Research Inst., Tokyo). J. Phys. Soc. Japan, 18: 610-19(May 1963). (In English)

The neutron total cross sections of silicon, phosphor, sulfur, and chlorine in the energy range from 3 to 5 Mev were measured with an energy resolution of 20 to 50 kev, and the variations of the cross sections with energy were analyzed statistically under the assumption that the variations arise from the fluctuation of the neutron widths and spacings of the resonances that are covered by the energy resolution. The average spacings D, which are obtained by the present analysis, are 1.3, 0.13, 0.54, and 0.04 kev for silicon, phosphor, sulfur, and chlorine respectively. These values agree well with those calculated by Cameron's semi-empirical formula. The neutron strength functions which are obtained also by the present analysis, are 2.9, 3.9, 3.8, and 4.7×10^{-4} for the respective elements, and are consistent with those obtained by the low-energy-neutron experiments. The correlation between the fluctuation of the total cross sections and the energy are obtained, and it is pointed out that there appear no signs of the fluctuations due to the existence of the large resonances, the width of which are comparable with or larger than the energy interval of about 100 kev. (auth)

28288 THE (α,p) REACTIONS ON LIGHT AND MEDIUM-WEIGHT NUCLEI. Takashi Yamazaki, Michiya Kondo, and Shotaro Yamabe (Osaka Univ.). J. Phys. Soc. Japan, 18: 620-38(May 1963). (In English)

Using ~22-Mev alpha particles the angular distributions of protons from (α,p) reactions on B^{10}, C^{12}, N^{14}, Na^{23}, Mg^{24}, P^{31}, S^{32}, Ca^{40}, Sc^{45}, Mn^{55}, Fe^{54}, Fe^{56}, and Co^{59} were measured. The angular distributions on the light nuclei show diffraction-like patterns, but those on the medium-weight nuclei are peaked at forward angle and decrease monotonically with angle. These angular distributions are fitted with theories of a stripping reaction. At first they are compared with a theory obtained by using plane-wave approximation for wave functions of incoming alpha particles and outgoing protons. They are also compared with a theory using a simple distorted-wave approximation which fits better with the experimental results. The values of parameters in the theoretical formula show systematic differences in cases that tritons are captured by target nuclei with angular momenta 0 and 2. Some results on spectroscopic investigations of the target or residual nuclei are also discussed. The (α,p), (α,n), and (p,α) reactions have a strong energy dependence near 20-Mev excitations, and above this region their energy dependences become smaller. (auth)

28289 YIELD OF PHOTODEUTERONS FROM NICKEL, COPPER, TIN, AND ANTIMONY. Mikio Yamanouchi (Tokyo Univ.). J. Phys. Soc. Japan, 18: 638-45(May 1963). (In English)

The yield of photodeuterons was investigated by using an improved method of grain counting. Grain density distributions of photodeuterons and photoprotons were clearly separated by density ratios 1.25-1.30 being in good accord with the value predicted for deuterons and protons by a former work. In the case of antimony, ratio of the yield of photodeuterons to that of photoprotons were determined to be as high as 0.13 ± 0.05 measured at the maximum bremsstrahlung energy of 24.0 Mev, which is in agreement with a value reported by Medicus. An energy spectrum of photodeuterons from antimony exhibited a peak in an energy region 8-9 Mev. The ratio for copper at an x-ray energy of 25.5 Mev were 0.06 ± 0.04 and 0.04 ± 0.02 measured at 90 and 126° to the x-ray beam, respectively. These values are the same order of magnitude as a value determined recently by Hamburger using a method of magnetic field and plates, but are inconsistent with values hitherto reported by all the other investigators. For nickel and tin, values of approximately 0.02 for 25.5-Mev x-rays and 0.04 for 24.0-Mev x rays, respectively, were obtained for the ratio. (auth)

28290 EXPERIMENT ON $O^{18}(p,\gamma)F^{19}$ REACTION. Kun-Kuang Huang, Kohsuke Yagi, Takashi Awaya, Hajime Ohnuma, Manabu Fujioka, and Yozo Nogami (Tokyo Univ.). J. Phys. Soc. Japan, 18: 646-52(May 1963). (In English)

Oxygen-18 was bombarded with protons having energies over a range from 570 to 1500 kev, and proton capture gamma rays were studied. Four resonance levels were observed at proton energies 628, 847, 1167, and 1397 kev, and their widths were estimated to be 2.7, 44, 0.6, and 3.7 kev, respectively. From an analysis of angular distributions of gamma rays emitted form the resonance level at $E_p = 1167$ kev, it was deduced that spin values of the 9.07-, 2.78-, and 1.35-Mev levels of F^{19} were $7/2$, $9/2$, and $5/2$, respectively. The results were compared with the theoretical predictions based on shell model and collective model calculations. (auth)

28291 DECAY OF 27 HOURS Ho^{166}. L. Funke, K. Hohmuth, H. Jungclaussen, K. Kaun, G. Mueller, H. Sodan, and L. Werner (Zentralinstitut für Kernphysik, Rossendorf, Ger.). Kernenergie, 6: 152-7(Apr. 1963). (In German)

A magnetic and scintillation spectrometer and a proportional counter were used to study the β spectra and γ radiation of 27-hr Ho^{166}. Ho^{166} was obtained by irradiation of Ho_2O_3 in a reactor and in a cyclotron and separating the reaction products in ion-exchange columns. For the Ho fraction an activity decrease with a half-life period of 26.8 ± 0.2 hr was ascertained. The limiting energies and intensities of the partial β spectra were established, and the intensities of the high-energy γ transitions in the decay-product Er^{166} were determined. The three low-energy β components of the Ho^{166} decay were detected by means of β-γ coincidence measurements. The limiting energy of the β transition from the 1824-kev level of Er^{166} was determined to be 35 ± 5 kev. (tr-auth)

28292 SOME STUDIES ON THE FORMATION OF Fe^{59} FROM Co^{59} BY FISSION NEUTRON BOMBARDMENT. K. Wagner and H. Poser (Zentralinstitut für Kernphysik, Rossendorf, Ger.). Kernenergie, 6: 177-8(Apr. 1963). (In German)

For the formation of Fe^{59} from the reaction $Co^{59}(n,p)Fe^{59}$ in the Rossendorf Reactor, an effective cross section of about 0.5 mb was found. The activation ratio Co^{60}/Fe^{59}

was 47 or 980 with and without shielding of the target with cadmium sheet. (tr-auth)

28293 ON THE ANALYSIS OF HIGH-RESOLUTION NUCLEAR MAGNETIC RESONANCE SPECTRA. I. METHODS OF CALCULATING N.M.R. SPECTRA. C. N. Banwell (Univ. of Sussex, Brighton, Eng.) and H. Primas. Mol. Phys., 6: 225-56(Apr. 1963).

Some new methods for analyzing high-resolution nuclear magnetic resonance spectra are discussed and exemplified by the two-particle AB system. A brief summary is first given of the traditional method that evaluates the resonance frequencies as differences between the hamiltonian eigenvalues, and the intensities as squares of the matrix elements of the dipole operator. The so-called direct method is then discussed, which gives the resonance frequencies and intensities directly as solutions of a new eigenvalue problem, involving the derivation superoperator of the hamiltonian. From the direct method the more elegant and compact correlation function method is developed, yielding the complete spectrum as a single entity. In all the methods the so-called level shift representation is also discussed, which may be advantageous for qualitative considerations of the spectrum and which is a convenient starting point for approximation methods. Mathematical concepts that may be new to the reader are explained in detail and exemplified. (auth)

28294 PHOTOPROTONS FROM N^{15}. E. Finckh, R. Kosiek, and K. Schluepmann (Universität, Heidelberg). Naturwissenschaften, 50: 326-7(1963). (In German)

The energy distribution of the photoprotons from N^{15} was investigated with 24.5- and 31-Mev bremsstrahlung energy. Gaseous N^{15} at a pressure of 800 torr was used as the target. The results of the measurement at 24.5 Mev show the previously announced maxima at $E_p = 3.2$, 4.5, and 9.5 Mev and a new maximum at $E_p = 8.7$ Mev. The results at 31 Mev show distribution changes that can be attributed to transitions in excited levels of C^{14} and to protons from (γ,np) processes. The integrated cross section for $E\gamma = 12.7$ to 31 Mev was calculated as 43 Mev mb ± 25%. (J.S.R.)

28295 PROPERTIES OF COMPOUND NUCLEUS FROM EXPERIMENTAL MEASUREMENT OF THE $Si^{28}(n,\alpha)Mg^{25}$ REACTION. L. Colli, I. Iori, M. G. Marcazzan, and M. Milazzo (Laboratori C.I.S.E., Milan). Nucl. Phys., 43: 529-36(June 1963). (In English)

The cross-sections of the $Si^{28}(n,\alpha)Mg^{25}$ reaction for the transition to the ground state and to the first nine excited states of the residual nucleus Mg^{25} were measured as a function of neutron energy. The measurement was made in the neutron energy range 12.15-18.5 Mev, with a beam resolution of about 50 kev from 12.15 to 14.5 Mev, 100 kev from 14.5 to 16.5 Mev, 150 kev from 16.5 to 18.5 Mev. A solid state semiconductor was used both as a target and as α-particles detector. The results of the measurements were analyzed with the theory of the compound nucleus recently developed by Ericson; in particular the amplitude and the width of the fluctuations predicted by this theory were calculated. The comparison between the theoretical and experimental values is discussed. (auth)

28296 BETA-GAMMA CIRCULAR POLARIZATION CORRELATION IN THE DECAY OF Sc^{46}. R. M. Singru and R. M. Steffen (Purdue Univ., Lafayette, Ind.). Nucl. Phys., 43: 537-46(June 1963). (TID-17966) (In English)

The β-γ circular polarization correlation in the decay of Sc^{46} was studied. The source ($ScCl_3$) was placed in an evacuated chamber and the measurements were made by employing four beta detectors at different angles. The value of the asymmetry parameter A in the β-γ circular polarization correlation expression $W(\theta,\tau) = 1 + (v/c)\tau A \cos\theta$ was found to be $A = 0.19 \pm 0.03$. This confirmed the existence of a large interference of the Fermi and Gamow-Teller components with $C_V M_F / C_A M_{GT} = -0.15 \pm 0.05$. Analysis of γ-γ directional correlation measurements in Ti^{46} indicates that static interactions cannot be held responsible for the attenuation of the β-γ circular polarization correlation observed previously. (auth)

28297 α-DECAY OF Am^{241}. S. A. Baranov, V. M. Kulakov, A. G. Zelenkov, and V. M. Shatinskii (Shatinsky) (Kurchatov Atomic Energy Inst., Academy of Sciences, Moscow). Nucl. Phys., 43: 547-52(June 1963). (In English)

The α-decay of Am^{241} is studied with a magnetic double-focussing α-spectrograph. Analysis of the spectrum revealed more than 18 fine-structure groups of the α radiation of the above isotope most of which are found for the first time. The scheme of the energy levels of the Np^{237} nucleus is constructed on the basis of the experimental data. A new rotational band is established in the scheme. (auth)

28298 THE SPIN SEQUENCE OF THE FIRST AND SECOND EXCITED LEVELS OF Ne^{19}. W. W. Givens, R. C. Bearse, G. C. Phillips, and A. A. Rollefson (Rice Univ., Houston, Tex.). Nucl. Phys., 43: 553-9(June 1963). (In English)

A magnetic-lens type beta-ray spectrometer was used to measure the relative intensities of internal conversion electrons and also of photoelectrically converted gamma-rays for ground state transitions of the first- and second-excited levels of Ne^{19}. These levels of Ne^{19} were excited by the reaction $F^{19}(p,n)Ne^{19*}$. The relative intensities of the internal conversion electrons and the photoelectrons show that the internal conversion coefficient for the first-excited to ground state transition is about an order of magnitude larger than the internal conversion coefficient for the second-excited to ground state transition. Therefore, the first-excited level of Ne^{19} must have a larger total angular momentum than the second-excited level. This result confirms the interpretation given to the mean life measurements of these transitions; consequently, the reversed spin sequence of the first- and second-excited levels in the mirror nuclei Ne^{19} and F^{19} appears now to be well established. The level energies inferred from the photoelectron and internal conversion electron spectra are 241 ± 4 and 271 ± 4 kev for the first- and second-excited levels of Ne^{19}. (auth)

28299 COULOMB EXCITATION OF Tb^{159}, Ho^{165}, AND Tm^{169} WITH O^{16} IONS. R. M. Diamond, B. Elbek, and F. S. Stephens (Univ. of California, Berkeley). Nucl. Phys., 43: 560-97(June 1963). (UCRL-10557). (In English)

The coulomb excitation of Tb^{159}, Ho^{165}, and Tm^{169} was studied using principally 60-Mev O^{16} ions as projectiles. Both gamma ray and conversion electron spectra were taken. Rotational bands observed at 514 and 687 kev in Ho^{165}, at 580 (and possibly ≈ 1280) kev in Tb^{159} and at 570 (and possibly ≈ 1170) kev in Tm^{169} were assigned as collective (gamma vibrational) bands. The bands at 361 kev in Ho^{165}, at 348 and 971 kev in Tb^{159} and at ≈900 kev in Tm^{169} are ascribed to intrinsic (Nilsson) configurations. The properties of these bands are discussed in some detail. By multiple excitation 6 or 8 members of each ground state rotational band were excited. The analysis of the energies of these levels indicates the presence of higher-order Coriolis terms in the rotational energy formula in the cases Tb^{159} and Tm^{169}. (auth)

28300 INELASTIC SCATTERING OF HIGH ENERGY NUCLEONS BY NUCLEI. Yoshihiko Nishida (Saga Univ., Japan). Nucl. Phys., 43: 598-619(June 1963). (In English)

A method is presented to test the validity of the impulse approximation without or with nuclear distortion in the calculation of inelastic scattering of high energy nucleons by nuclei. The inelastic scattering of 182-Mev protons by C^{12} with the excitation of the 4.43, 7.66, and 9.63 Mev levels is investigated as an example. In the impulse approximation without nuclear distortion the relevant matrix element can be obtained empirically by means of the experimental data regarding the inelastic electron scattering on C^{12}. The effect of the nuclear distortion by a square well optical potential is investigated in detail for the excitation of the 4.43-Mev level. That part in the relevant matrix element that contains the wave functions of the ground and excited states can empirically be determined by means of the inelastic electron scattering data and the observed life time of the level against E2 transition to the ground state. The calculation indicates that the nuclear distortion mainly makes the position of the maximum in the differential cross section shift towards smaller scattering angles. The result of the present analysis shows that whether the impulse approximation without or with nuclear distortion is valid or not depends sensitively on the level structure. It is concluded that the single inelastic collision mechanism involved in the present impulse approximation calculations is valid for the excitation of an independent particle level, while the stronger the many-particle features in a level become, the less valid it becomes and the more significant the effect of the multiple inelastic scattering becomes. 45 references. (auth)

28301 SCATTERING OF 14 Mev NEUTRONS FROM ^{12}C AND EXCITATION OF THE 7.65 Mev LEVEL. R. Bouchez, J. Duclos, and P. Perrin (Université, Grenoble, France and Centre d'Etudes Nucléaires, Grenoble, France). Nucl. Phys., 43: 623-35(June 1963). (In English)

The excitation of the 7.65-Mev level (0^+) in the inelastic scattering of 14-Mev neutrons from C^{12} was observed. The angular distribution gives a strong forward maximum $\sigma(\theta) \approx 8$ mb/sr at $\theta = 20°$ (about 0.1 of the 4.43 Mev level excitation cross section). The simple Bessel-function distribution $j_0^2(kR)$, with $R \approx 5.4$ fm for the nuclear interaction radius, agrees, at first sight with data (except at wide angles) suggesting a direct-interaction process (α-cluster excitation). Experimental differential cross sections are also presented for elastic scattering and for the 4.43 and 9.63-Mev levels. (auth)

28302 EFFECTIVE NUCLEAR INTERACTIONS. S. P. Pandya (Univ. of California, Los Angeles). Nucl. Phys., 43: 636-49(June 1963). (In English)

The energy level spectra of O^{17}, O^{18}, O^{19}, and O^{20} are analyzed in the framework of the nuclear shell model. The matrix elements of the effective interaction in various two-particle states are deduced. It is shown that the singlet even interaction is not only short-ranged and attractive, but also contains a strongly repulsive central region. This demonstration of a repulsive non-singular core is the essential conclusion. It is also suggested that it may not be possible to represent the effective triplet odd interaction by a simple central potential. An experimental determination of the 3^+ state in O^{18} would throw further light on this question. The excitation energy of this state is predicted. (auth)

28303 MEASUREMENT OF THE DECAY SCHEME OF I^{131}. H. Jungclaussen, J. Schintlmeister, and H. Sodan (Zentralinstitut für Kernphysik, Rossendorf, Ger.). Nucl. Phys., 43: 650-61(June 1963). (In German)

The decay scheme of I^{131} was examined with the help of different types of scintillation spectrometers and a magnetic spectrometer. In addition to the already known γ-transitions a 644-80 kev γ-cascade transition was observed. The intensity of the 644-kev γ-radiation is $0.22 \pm 0.04\%$ relative to that of the 364 kev γ radiation. It was also observed that the 507 kev γ radiation occurs in coincidence with a β component, whose maximum energy lies between 246 and 332 kev. A new decay scheme is proposed. (auth)

28304 INELASTIC PROTON SCATTERING ON COMPLEX NUCLEI AT 27 Gev. H. Goeing (Max-Planck-Institut für Physik und Astrophysik, Munich). Nucl. Phys., 43: 662-8(June 1963). (In English)

Inelastic interactions of 27-Bev protons (CERN proton beam) on complex nuclei were studied. It is shown that particles producing cascades in the nuclei in which they are produced play no important role. Dividing the events in p-p and p-n interactions the primary nucleons were separated, and the differential and integral angular distributions of the produced π mesons were measured. There is a very small anisotropy in the c.m.s. For the pions a mean energy of $\gamma_{\pi\pi} = 2.18 \pm 0.5$ (rest mass units) is calculated. The degree of inelasticity $K_\pi = 0.29 \pm 0.08$ agrees with a theory of Heisenberg. (auth)

28305 LEVELS OF THE NUCLEUS Sm^{150} EXCITED IN THE (n,γ) REACTION. L. V. Groshev, A. M. Demidov, V. A. Ivanov, V. N. Lutsenko, and V. I. Pelekhov (Kurchatov Atomic Energy Inst., Academy of Sciences, Moscow). Nucl. Phys., 43: 669-83(June 1963). (In English)

The spectra of γ-rays and internal conversion electrons emitted in the capture of thermal neutrons of Sm^{149} are measured with magnetic spectrometers. A scheme of γ-transitions of the nucleus Sm^{150} is suggested. The levels of the nuclei Sm^{150} and Gd^{152} are compared. (auth)

28306 THE ELASTIC SCATTERING OF DEUTERONS BY VANADIUM. A. García (Univ. of Valencia) and A. E. Forest. Nucl. Phys., 43: 687-93(June 1963). (In English)

The $V^{51}(d,d)V^{51}$ elastic scattering was studied at incident energies of 8-10.5 Mev with a 24-channel magnetic spectrograph. Angular distributions over the range 12°30′ to 175° (L.S.) were measured. The experimental results are compared with several calculations based on the optical model. (auth)

28307 ACCURATE DOPPLER BROADENED ABSORPTION. G. W. Hinman, G. F. Kuncir, J. B. Sampson, and G. B. West (General Atomic Div., General Dynamics Corp., San Diego, Calif.). Nucl. Sci. Eng., 16: 202-7 (June 1963).

A method for determining Doppler broadening which is rigorous for a Maxwellian gas of resonance absorber atoms was reduced to computation. Doppler broadened absorption cross sections for low-lying resonances of Er^{167} and Xe^{135} were computed both by this more accurate method and by the ψ-function approximation which is in general use. The more accurate method was found to give a correction, compared with the $e\psi$-function method, which was several percent in the case of Xe^{135} and was less than 1% for Er^{167}. The time required for the more accurate computation was found to be short enough to be practical for those special applications where it is of interest. (auth)

28308 EFFECT OF TEMPERATURE VARIATION ON "INTERMEDIATE-RESONANCE" FORMULAS. M. H. McKay (Univ. of New South Wales, Kinsington, Australia)

and J. P. Pollard. Nucl. Sci. Eng., 16: 243-5(June 1963). (AAEC/TM-173)

Calculations were made on the effects of working temperatures on the "intermediate-resonance" interpolation formulas of Goldstein and Cohen (ibid., 13: 132) for effective resonance integrals in homogeneous systems. The results, computed by a numerical FORTRAN procedure, are tabulated for several resonances of U^{238} in a homogeneous 1:1 dilution in H_2 and for the 192-ev resonance of U^{238} in 1:1 to 1:100 dilutions in H_2 at 0 to 900°K. It is concluded that the temperature variation has only a small effect on the integral. (D.L.C.)

28309 THE AVERAGE CAPTURE FISSION/RATIO OF U^{233} FOR EPITHERMAL NEUTRONS. J. Halperin, F. J. Johnston, R. W. Stoughton, J. H. Oliver, E. L. Blevins, R. E. Druschel, A. L. Harkness, and B. A. Swarz (Oak Ridge National Lab., Tenn.). Nucl. Sci. Eng., 16: 245-7(June 1963).

Epithermal capture and fission values of U^{233} were compared with the thermal values by the use of Cd ratios, radiochemical analyses of fission products, and mass spectrographic U^{234}/U^{233} ratios. The 2200 m/sec capture resonance integral was found to be 147 b while the fission integral was 865 ± 40 b; their ratio gave an average capture/fission ratio $\alpha_{epi} = 0.170 \pm 0.017$, which compares with $\alpha_{th} = 0.100$. The effect of the α_{epi} on thermal breeding is expressed as η_{eff}/η_{th}, where η_{eff} = effective number of neutrons produced/neutron absorbed in fuel; η_{eff}/η_{th} = 0.994 and 0.988 for the epithermal fractions $f_{epi} = 0.1$ and 0.2, respectively. (D.L.C.)

28310 THE ISOMERISM OF In^{116}. K. F. Alexander, H. F. Brinckmann, F. Doenau, and H. R. Kissener (Zentralinstitut für Kernphysik, Rossendorf, Ger.). Phys. Letters, 4: 302-4(May 1, 1963). (In German)

From the activation cross sections of the In^{116} isomers and the knowledge of the spin of the ground state and of the 54-min isomer, indications on the spin of the 2.16-sec isomer can be obtained. The activation ratios for the three isomers graphed as a function of the spin of the 2.16-sec isomer and experimental data can be explained by assignment of spin 5 to this isomer. Spin 4 or 6 must also be considered because of experimental uncertainties and the qualitative character of the cascade statistics. Configurations are proposed within the framework of the shell model with jj coupling. The strong forbiddenness for E1 and M2 transitions between both isomeric states are explained. (J.S.R.)

28311 SPIN, HYPERFINE STRUCTURE, AND NUCLEAR MAGNETIC DIPOLE MOMENT OF O^{15}. E. D. Commins and H. R. Feldman (Columbia Univ., New York). Phys. Rev., 131: 700-7(July 15, 1963).

The nuclear spin and hfs splitting of O^{15} in the $P_{\frac{1}{2}}^2$ atomic ground state were determined by the atomic beam magnetic resonance method. O^{15} was produced in the reaction $N^{14}(d,n)O^{15}$ by allowing a 5-Mev deuteron beam to impinge upon a gaseous N_2 target. The radioactive gas flowed continuously from the target chamber into the microwave discharge source of the atomic beam apparatus. A rotating-wheel deposition detector specially suited for short-lived radioactive atoms was used to detect the beam. The spin is found to be $\frac{1}{2}$, in agreement with the shell-model prediction. The hfs splitting of O^{15} in the $P_{\frac{1}{2}}^2$ state is observed to be 1037.23 ± 0.07 Mc, and the nuclear magnetic dipole moment of O^{15} is deduced to be 0.7189 ± 0.0008 nm. (auth)

28312 OPTICAL DOUBLE RESONANCE IN RADIOACTIVE ATOMS: SPIN AND NUCLEAR MOMENTS OF THE GROUND STATE OF Cd^{109}. M. N. McDermott and R. Novick (Columbia Univ., New York). Phys. Rev., 131: 707-18(July 15, 1963).

The optical double-resonance technique was employed for the study of the Zeeman effect and hyperfine structure of the (5s5p) P_1^3 state of 470-day Cd^{109}. The nuclear spin, I, magnetic hyperfine interaction constant, A, and quadrupole interaction constant, B, are: $I = \frac{5}{2}$, $A = -1$, 148.6 ± 2.0 Mc, and $B = -167.3 \pm 2.0$ Mc. If nuclear structure and quadrupole antishielding corrections are neglected, the corresponding nuclear moments are $\mu = -0.8286(15)\mu_N$ and $Q = +0.78(10)$ b. These values are discussed in terms of the configuration mixing model of Arima and Horie. A number of the problems encountered in the application of the double resonance technique to radioactive atoms are discussed. The sensitivity of the method is limited by the shot noise in the instrumentally scattered light. In the case of the present apparatus, Zeeman resonances are detectable with 2×10^8 cadmium atoms in the vapor phase. (auth)

28313 TRANSITION RADIATION AND OPTICAL BREMSSTRAHLUNG FROM ELECTRON-BOMBARDED THIN GOLD FOILS. E. T. Arakawa, L. C. Emerson, D. C. Hammer, and R. D. Birkhoff (Oak Ridge National Lab., Tenn.). Phys. Rev., 131: 719-22(July 15, 1963).

Unbacked gold foils 340 and 530-Å thick were bombarded by a 1.5-μa electron beam of energy 25 to 100 kev. The light emitted at 30° from the foil normal on the beam exit side was analyzed between 2500 and 5500 Å with a vacuum ultraviolet spectrometer and a glan prism polarizer. The spectral distribution and absolute photon yield in the plane containing the electron beam and photon direction agree well with the transition radiation theory if the bremsstrahlung contribution is assumed to be unpolarized. The photon intensity perpendicular to the plane has the dependence on primary energy indicated by the bremsstrahlung theory of Gluckstern, Hull, and Breit, but only 40% of the expected absolute value. The discrepancy is thought to be due to neglect of optical absorption and refraction in the calculation. (auth)

28314 FISSION FRAGMENT ANGULAR DISTRIBUTIONS AND CROSS SECTIONS FOR DEUTERON-INDUCED FISSION. George L. Bate, R. Chaudhry, and J. R. Huizenga (Argonne National Lab., Ill.). Phys. Rev., 131: 722-34 (July 15, 1963).

Fission-fragment angular distributions and cross sections were measured with gold surface barrier semiconductor detectors for fission induced in a group of elements from Tl to Pu by deuterons of 7 to 21-Mev energy. Apart from a pronounced dip in the radium region, the differential fission fragment cross-section ratios W(174°)/W(90°) at 21 Mev show an increasing trend with decreasing Z^2/A, the values ranging from 1.20 for Pu^{239} to 1.58 for natural Tl. Values of K_0^2 are calculated from the experimentally determined anisotropies for targets in which single-chance fission prevails, i.e., Bi^{209} and nuclides in the plutonium region. When values of K_0^2 for plutonium are compared with those from available neutron fission data, there is indicated an anomalous suppression of K_0^2 in the low-energy region below the values extrapolated from the higher energy data by plausible temperature dependences on excitation energy. Saddle-shape calculations and semi-quantitative arguments that are reviewed lend added credence to the view that the saddle shape is independent of the mode of formation. The experimentally observed change in anisotropy with the fissionability parameter x is correlated with the effective moments of inertia at the saddle configuration, indicating that thermodynamic equi-

librium is first established near the saddle point in fission. Fission cross sections measured for Th^{232}, U^{233}, and U^{238} are supplemented by previously determined spallation cross sections to obtain total deuteron reaction cross sections. At 21 Mev the deuteron reaction cross section of heavy elements is found to be 1800 mb. The experimental reaction cross sections are compared with theoretical values calculated with a volume-absorption optical model. (auth)

28315 NUCLEAR STRUCTURE STUDIES IN THE PALLADIUM ISOTOPES WITH (d,p) AND (d,t) REACTIONS. Bibijana Čujec (Univ. of Pittsburgh). Phys. Rev., 131: 735-44(July 15, 1963).

Many new energy levels are located in the odd-A palladium isotopes and the spin and parity values assigned. The parameters of the pairing theory, such as the single quasiparticle energies, the occupation numbers, the strength of the pairing interaction, etc., are evaluated. By means of them, the single-particle energies are obtained and compared with other nuclei of the same neutron shell. While the orbits $2d_{5/2}$, $3s_{1/2}$, and $2d_{3/2}$ do not change their relative locations significantly, the $1g_{7/2}$ orbit shows drastic changes. In the palladium isotopes the $1g_{7/2}$ orbit is found to be below the $2d_{3/2}$ orbit, while in zirconium it is as high as the $2d_{3/2}$ orbit, and in tin somewhat above the $2d_{3/2}$ orbit. This indicates that the interaction between the $1g_{7/2}$ neutrons and the $1g_{9/2}$ protons, which causes the shift of the $1g_{7/2}$ orbit, is most effective in palladium isotopes, i.e., where the $1g_{9/2}$ proton orbit is about half-full. The strength of the pairing interaction is evaluated to be GA = 29.2 ± 0.9 Mev. (auth)

28316 OPTICAL-MODEL ANALYSIS OF PROTON ELASTIC SCATTERING IN THE RANGE OF 9 TO 22 Mev. F. G. Perey (Oak Ridge National Lab., Tenn.). Phys., Rev., 131: 745-63(July 15, 1963).

For incident proton energies between 9 to 22 Mev, 35 elastic scattering angular distributions were analyzed with the optical model using a least-square criteria over the complete angular range of the data. The observed increase of the real well depth as a function of mass number is explained by the presence of a nuclear symmetry term in the potential and by the momentum dependence of the potential. The polarization and reaction cross-section data are in good agreement with the calculations. The effect of core excitations on the parameters of the optical model are studied, and the relative importance of volume and surface imaginary potentials is discussed. Formulas are given to obtain the value of the parameters of the optical model as a function of mass number and energy. (auth)

28317 REACTIONS INDUCED IN Ni^{58} WITH 0-24 Mev DEUTERONS: STATISTICAL MODEL ANALYSIS. Marshall Blann and George Merkel (Univ. of Rochester, N. Y.). Phys. Rev., 131: 764-72(July 15, 1963).

Excitation functions for $Ni^{58}(d,\alpha)$, $(d,\alpha p)$, $(d,\alpha n)$, (d,2pn), (d,2np), and $Ni^{60}(d,2\alpha)$ reactions were measured radiochemically for deuteron energies up to 24 Mev. The decrease in the (d,α) excitation curve above the threshold of competing reactions such as $(d,\alpha p)$ and $(d,\alpha n)$ is consistent with the qualitative behavior of compound-nucleus reactions. The experimental results were compared with statistical-model calculations that assume nuclear level densities of the form $\rho(E) \propto (2J + 1)E^{-2} \exp[2(aE)^{1/2}]$, where the excitation energy E was corrected for pairing. The value of the parameter a was set equal to the experimental value determined by Brady and Sherr. Cross sections were calculated for all permutations of n, p, d, t, He^3, and α emission for two successive evaporations, followed by a calculation of a third evaporation of a neutron, proton, or alpha particle where it was energetically possible. In these calculations the inverse cross sections of particles with energy ϵ, $\sigma_{inv}(\epsilon)$, were assumed to be of the following forms: for neutrons, $\sigma_{inv}(\epsilon) = \sigma_1(1 + \epsilon_n/\epsilon)$; for charged particles, $\sigma_{inv}(\epsilon) = \sigma_2(1 - \epsilon_c/\epsilon)$ when $\epsilon > \epsilon_c$, and $\sigma_{inv}(\epsilon) = 0$ when $\epsilon < \epsilon_c$. The parameters σ_1, ϵ_n, σ_2, and ϵ_c were chosen so that values of $\sigma_{inv}(\epsilon)$ would approximate optical-model calculations of the capture cross sections. Two sets of compound-nucleus excitation functions were calculated. In the first set the alpha-particle and the proton inverse cross sections, $\sigma_{inv}(\epsilon)$, were chosen to correspond to optical-model reaction cross sections calculated with parameters deduced from experimental elastic scattering. In the second set of compound-nucleus excitation function calculations the inverse cross sections, $\sigma_{inv}(\epsilon)$, were chosen to correspond to nuclear radii 10% smaller than those used in the first set of calculations. The experimental excitation functions nearly all fall between the two sets of calculated functions. (auth)

28318 ALPHA DECAY OF Cf^{246}. A. M. Friedman and J. Milsted (Argonne National Lab., Ill.). Phys. Rev., 131: 772-3(July 15, 1963). (TID-18356; UAC-7255)

A sample of Cf^{246} was prepared by intensive alpha bombardment of Cm^{244}. The alpha spectrum was studied by use of silicon surface barrier detectors having a resolution of 18 kev at 6.7-Mev alpha energy. The alpha energies and intensities found for the transitions were: 6.753 Mev, 77.9 ± 0.2%; 6.714 ± 0.0007 Mev, 21.9 ± 0.2%; 6.621 ± 0.001 Mev, 0.18 ± 0.02%; and 6.465 ± 0.003 Mev, undetermined intensity. The energies can be fitted by the expression $E = 6.46I(I + 1) + 0.0074I^2(I + 1)^2$ kev and the relative intensities by $C_0 : C_2 : C_4 = 1 : 0.42 : 0.080$, where the C's are the reciprocals for the hindrance factors of the various L waves. (auth)

28319 DOUBLE ISOMERISM IN As^{73}. H. H. Bolotin (Argonne National Lab., Ill.). Phys. Rev., 131: 774-7 (July 15, 1963).

The levels in As^{73}, populated by the decay of Se^{73}, were studied. States at 0.425 and 0.066 Mev were found to decay by means of two cascade gamma rays with energies of 0.359 and 0.066 Mev, with no observed crossover transition. Half-lives of 5.0 ± 0.4 μsec and 6.1 ± 0.4 nsec were measured for the 0.425 and 0.066 Mev states, respectively. The 0.066-Mev transition, previously assigned as M1, was found to be retarded by a factor of 97 compared to single-particle estimates. This result tends to confirm the l-forbidden character of this transition. This retardation is compared with that for the 0.068-Mev transition in Ni^{61}, which proceeds between analogous states. (auth)

28320 CAPTURE-GAMMA DETERMINATION OF CHROMIUM-54 STRUCTURE. Donald H. White (Univ. of California, Livermore). Phys. Rev., 131: 777-86(July 15, 1963). (UCRL-7216)

Gamma emission following therma-neutron capture in separated chromium-53 was studied using a fast coincidence scintillation spectrometer. A quartz-crystal thermal-neutron filter is described that produces a flux of 10^6 neutrons/cm^2 sec at the target with a cadmium ratio better than 10^4. Capture gammas are observed at 9.72, 8.88, 7.10, 6.88, 6.64, 6.28, 6.00, 4.86, 3.72, 2.60, 2.24, 2.00, 1.77, and 0.84 Mev. Cascade transitions were studied using coincidence, sum coincidence, and angular correlation methods. A double-window coincidence technique used in these measurements is described. This technique systematically subtracts coincident background and is particularly applicable to angular correlation measurements. Energy levels are established at 0.84, 2.61, 2.84, 3.08, 3.44, 3.72, and 4.86 Mev. The spins of the first four

excited states are 2, 2, 0, and 2, respectively, as determined by angular correlation and cascade systematics. The results are discussed in terms of recent nuclear models. (auth)

28321 PROPERTIES OF EXCITED STATES OF P^{31}. II. GAMMA-RAY ANGULAR DISTRIBUTIONS AND CORRELATIONS. Gale I. Harris (Aeronautical Research Labs., Wright-Patterson AFB, Ohio), and L. W. Seagondollar. Phys. Rev., 131: 787-804(July 15, 1963).

Angular distributions and triple correlations of gamma rays emitted from several resonances in the range E_p = 1177 to 1509 kev in the $Si^{30}(p,\gamma)P^{31}$ reaction were measured using thin, highly enriched Si^{30} targets. The angular distributions and correlations lead to the resonance level assignments 1177($^7/_2$), 1204($^5/_2$), 1324($^5/_2$), 1392($^5/_2$), 1400($^3/_2$), 1489($^3/_2$), and 1509($^5/_2$) where the proton resonance energies are in kev. The results indicate even parity for all of the resonances if it is assumed that all gamma-ray multipolarity mixings are of the form E(L + 1)/M(L). The mixing ratios are presented for most of the observed primary transitions and of several secondary transitions. The results of this study are consistent with the assignments $^3/_2$+, $^5/_2$+, $^3/_2$+, $^5/_2$+, $^3/_2$+, and $^5/_2$+ made elsewhere for the 1.27, 2.23, 3.13, 3.29, 3.51, and 4.19-Mev levels of P^{31}. The 3.41-Mev level is identified as $^7/_2$+ by means of angular-distribution and correlation measurements at the 1509-kev resonance. A $^7/_2$+ assignment for the 3.41-Mev level casts doubt upon the existence of a weak transition from that level to the $^1/_2$+ ground state. Results of several measurements designed to determine the origin of the weak gamma-ray peak of approximately 3.4 Mev in coincidence spectra at the 1509-kev resonance were inconclusive. Angular distributions at the 1204-kev resonance lead to the assignment of $^3/_2$+ to the 4.26-Mev level. Limitations are placed on the possible assignments for the 4.43 and 5.01-Mev levels. Both members of the doublet near E_p = 1481 kev are found to decay mainly to the ground state and each have J = $^3/_2$ on the basis of angular distributions. The value of $\Gamma_p \Gamma_\gamma / \Gamma_t$ was determined for each of the resonances. Results of this study are discussed in terms of recent collective model calculations for P^{31}. (auth)

28322 INTERFERENCE OF K-CAPTURE, GAMMA TRANSITIONS THROUGH A VIRTUAL STATE, AND INNER BREMSSTRAHLUNG TRANSITIONS. Kenneth E. Lassila (Case Inst. of Tech., Cleveland). Phys. Rev., 131: 807-10(July 15, 1963).

The energy distribution of photons emitted during the transition from the ground state of Ni^{59} to that of Co^{59} was calculated with allowance being made for interference between the K-capture, γ-ray transition through a virtual intermediate excited state of Co^{59} and the second forbidden K-capture transition, accompanied by inner bremsstrahlung, between ground states. The effect of the transition through the virtual state is to introduce terms in the photon energy distribution whose maxima are at higher energies than those resulting from inner bremsstrahlung transitions. In particular, the energy distribution for the leading interference term is similar to that used by Schmorak, who found that a better fit to his data was obtained by assuming that the virtual capture transition exists. Thus, the present calculation confirms Schmorak's method of analysis and, therefore, gives support for the existence of the virtual capture transition. (auth)

28323 (d,p) REACTION ON THE TITANIUM ISOTOPES. J. L. Yntema (Argonne National Lab., Ill.). Phys. Rev., 131: 811-17(July 15, 1963). (TID-18837)

The (d,p) reaction on Ti^{46}, Ti^{47}, Ti^{48}, Ti^{49}, and Ti^{50} was studied at an incident-deuteron energy of 21.4 Mev. Absolute differential cross sections and angular distributions for a number of transitions are reported. A number of previously unreported levels are found in Ti^{51}, Ti^{50}, Ti^{49}, Ti^{48}, and Ti^{47} while a few levels reported in the literature do not appear to exist. The angular distributions are compared with distorted-wave Born approximation calculations and the spectroscopic factor is obtained for a number of transitions. The results are compared with those from the (d,t) reaction. The present experiment indicates that seniority mixing occurs in the titanium isotopes. (auth)

28324 SPIN-PARITY COMBINATIONS FOR LEVELS IN Mg^{24} AND Si^{28}. J. E. Evans, J. A. Kuehner, A. E. Litherland, and E. Almqvist (Atomic Energy of Canada Ltd., Chalk River, Ont.). Phys. Rev., 131: 818-21 (July 15, 1963).

Parities of levels in Mg^{24} and Si^{28} were found from observations on alpha-particle groups emitted in the forward direction following bombardment of O^{16} by C^{12} and O^{16} ions. The interpretation depends only on conservation laws and not on any assumption about the reaction mechanism. Of the lowest seven known states of Mg^{24} [E_{ex} = 0, 1.37, 4.12, 4.23, (5.22), 6.01, 6.43 Mev] and the lowest five of Si^{28} [E_{ex} = 0, 1.77, 4.62, 4.98, (6.28) Mev] only the two in parentheses have parity $(-)^{J+1}$. The spins (J) of all these levels are known, and because these two are the only members with J odd, it follows that all 12 levels have positive parity. (auth)

28325 L/K-CAPTURE RATIO IN Mn^{54}, Fe^{55}, Co^{57}, AND Co^{58} DECAYS. R. B. Moler and R. W. Fink (Univ. of Arkansas, Fayetteville). Phys. Rev., 131: 821-9 (July 15, 1963).

The multiwire proportional counter method was applied to measurements of the L and K radiations arising from orbital electron-capture in gaseous sources of 290-day Mn^{54}, 2.6-yr Fe^{55}, 270-day Co^{57}, and 72-day Co^{58}. The presence of gamma transitions and positrons in the decay of Mn^{54}, Co^{57}, and Co^{58} is shown not to interfere with an accurate measurement of the L/K-capture ratio. The experimental values of the L/K-capture ratio are 0.098 ± 0.006, 0.106 ± 0.005, 0.099 ± 0.011, and 0.108 ± 0.004 for Mn^{54}, Fe^{55}, Co^{57}, and Co^{58}, respectively. The result for Fe^{55} is in excellent agreement with the earlier value measured by Scobie, Moler, and Fink, although the present value was corrected for counter escape somewhat more exactly. These values lie above the theoretical results of Brysk and Rose by some 9% for Mn^{54}, 9.3% for Fe^{55}, 7% for Co^{57}, and 17% for Co^{58}. These discrepancies are reduced by application of the exchange correction pointed out by Bahcall to the theoretical results of Brysk and Rose. This correction for the effect of exchange among the various electrons participating in the electron capture process apparently explains the well-established general discrepancy between the precision experimental values and the theory of Brysk and Rose. Remaining slight discrepancies probably can be traced to systematic experimental errors. (auth)

28326 ISOSPIN SELECTION RULES FOR HIGH-ENERGY ELECTRON SCATTERING. J. M. Eisenberg and M. E. Rose (Univ. of Virginia, Charlottesville). Phys. Rev., 131: 848-53(July 15, 1963).

The validity of Siegert's theorem and the isospin selection rule for electric and magnetic dipole transitions was established for inelastic electron scattering, thus extending the well-known results obtained for real photons. Siegert's theorem is obtained with arbitrary electron wave functions for electric multipole transitions provided:

$(k_0R)^2 \ll 1$, where k_0 is the energy transfer, and finite nuclear size effects are ignored. However, the latter assumption follows provided $(kR)^2 \ll 1$ (k is the momentum transfer) and this is valid only for small scattering angles. For light elements the isospin selection rule operates for E1 transitions in the forward cone only (≲30°). The M1 selection rule also follows with $(kR)^2 \ll 1$ and, therefore, operates in the same angular range. The angular distributions should exhibit an anomalous depression in the forward cone of half angle about 1/ER. Coulomb effects will then be decisive in determining the magnitude of the small-angle scattering. The same considerations are applicable to internal pair formation and internal conversion where the retardation assumption is valid in general under usual conditions. (auth)

28327 ISOMERIC STATES OF Y^{90}. S. Abecasis, H. Bosch, M. C. Caracoche, A. Mocoroa, and H. Vignau (Universidad Nacional, La Plata). Rev. Union Mat. Arg., Asoc. Fis. Arg., 21: 104-12(1962). (In Spanish)

The β and γ spectra of Y^{90} obtained from the $Y^{89}(n,\gamma)$, $Nb^{93}(n,\alpha)$, and $Zr^{90}(n,p)$ reactions were studied. The γ spectrum shows rays at 0.200 and 0.475 Mev, characterized by a period of 3.15 ± 0.05 hr. The non-existence of high energy gamma rays and the non-existence of a beta spectrum superposed on the β spectrum corresponding to the transition between the ground levels of Y^{90} and Zr^{90} lead to the supposition that there is no branching from the isomeric levels of Y^{90} to the excited levels of Zr^{90}. (tr-auth)

28328 GAMMA RAYS FROM THE 992 Kev $Al^{27}(p,\gamma)Si^{28}$ RESONANCE. L. Simons, K.-E. Nysten, M. Koskelin, O. Siltanen, E. Spring, and G. Wendt. Soc. Sci. Fennica, Commentationes Phy.-Math., 27: 1-20(1962). (In English)

Gamma-ray and coincidence spectra at the 992 kev resonance in the $Al^{27}(p,\gamma)Si^{28}$ reaction were measured. A level scheme in Si^{28} populated by this resonance is proposed. Moreover, the angular distributions for the 10.76 Mev and 1.77 Mev gamma rays were measured, and by means of these the conclusion that the resonance level at 12.54 Mev in Si^{28} has the spin and parity 3^+ is drawn. (auth)

28329 A VERY SHORT-TIME PULSED SOURCE OF FAST NEUTRONS. Benedikt Kronast. Z. Angew Phys., 15: 377-91(May 1963). (In German)

It is shown that a low-pressure, high-voltage discharge in deuterium gas can be used quite simply for production of short pulses of fast neutrons. The discharge gap, with cathodes formed from titanium deuteride targets, is described. The transient course of neutron emissions as well as the dependence of total neutron yield on discharge pressure and on the voltage charge of the discharge condensors were traced with scintillation counters. For voltages of 140 kv and deuterium discharge pressures of about 7×10^{-2} torr. A peak source strength of neutrons from the $D(d,n)He^3$ reaction of between 10^{11} and 10^{12} neutrons/sec was achieved. The half life of neutron emission varied with discharge pressure and voltage between 3×10^{-8} and 13×10^{-8} sec. A model representation was developed and tested. (M.C.G.)

28330 ON THE SOLUTION OF THE BETHE-GOLDSTONE EQUATION FOR NON-DISAPPEARING TOTAL IMPULSE. [PART] II. Dallas T. Hayes (Universität, Göttingen, Ger.). Z. Naturforsch., 18a: 559-69 (May 1963). (In German)

The investigation of the localized solutions of the Bethe-Goldstone equation begun in a previous paper was continued for the case where the two-nucleon potential contains a hard core. The presence of the hard core in the potential necessitates the use of another method of solution of the equation. Using a square well for the attractive part of the potential a numerical solution of the equation was obtained. As was the case without hard core the localized solution as a function of the center-of-mass momentum (c.m.m.) of the nucleon pair existed only in the immediate vicinity of zero c.m.m. The hard core resulted in a decrease of the energy-separation of the energy of the solution as measured from the double Fermi-energy. The dependence of the energy of the solution upon the c.m.m. was similar to that obtained for a square-well potential without hard core. (auth)

28331 THE α SPECTRUM FROM THE DECAY OF Li^8. János Darvas (Universität, Göttingen, Ger.). Z. Naturforsch., 18a: 569-76(May 1963). (In German)

The energy distribution of α particles from the β-α decay of Li^8 over the first excited state of Be^8 can be determined by means of the normalization integral over the α-α scattering solution. Relating the relevant part of this integral to the phase shift, the α spectrum may be obtained using one phenomenological parameter only. The calculation gives a correct fit to the experimental energy distribution, excepting a small region around the maximum. (auth)

28332 MEASUREMENTS OF THE LOW-ENERGY GAMMA SPECTRA OF Cd^{114}, Ho^{166}, AND Eu^{154}. Severin Orecher (Technische Hochschule, Munich). Z. Naturforsch., 18a: 576-9(May 1963). (In German)

Using an x-ray spectrometer operating in a DuMond arrangement with a bent crystal, the low-energy gamma lines from thermal neutron capture by Cd^{114}, Ho^{166}, and Eu^{154} were measured. (tr-auth)

28333 INVESTIGATION OF THE LIFETIME OF EXCITED NUCLEAR LEVELS OF Ca^{42}. D. Bloess and F. Muennich (Technische Hochschule, Brunswick). Z. Naturforsch., 18a: 671-2(May 1963). (In German)

The lifetimes of the first and second excited states of Ca^{42} were investigated using a slow-fast arrangement of transistorized time-to-pulse height converters. The half-life period of the 1.52-Mev level was found to be $(1.1 \pm 0.5) \times 10^{-10}$ sec. For the 1.84-Mev level a value of $(4.2 \pm 1.1) \times 10^{-10}$ sec was obtained for the half-life period. (M.C.G.)

28334 SPALLATION OF Fe NUCLEI INDUCED BY 150 Mev PROTONS. A. K. Lavrukhina, L. D. Revina, V. V. Malyshev, and L. M. Satarova. Zh. Eksperim. i Teor. Fiz., 44: 1429-36(May 1963). (In Russian)

The main features of the spallation of Fe nuclei by E_p = 150-Mev protons are studied. Most of the nuclear products are found to group along the bottom of a stability valley. The production cross sections for the spallation can be described. The weighted mean number of emitted neutrons and protons are 2.9 and 2.7 respectively. The cross section for inelastic interaction between 150-Mev protons and Fe nuclei is 568 ± 162 mb. Comparison of σ_{inel} with calculations based on the optical model yields $R(Fe^{56}) = 1.21 \cdot 10^{-13}$ cm. The E_p dependence of the production cross sections for various nuclei from Fe^{56} can be explained by the increase of the nuclear excitation energy as a result of formation and reabsorption of π mesons at $E_p \geq 200$ Mev. (auth)

28335 GROSS STRUCTURE OF THE NEUTRON ENERGY SPECTRUM AND POLARIZATION IN (d,n) REACTIONS ON INTERMEDIATE MASS NUCLEI. I. I. Levintov, V. V. Okorokov, V. A. Smotryaev, D. L. Tolchenkov, and I. S. Trostin (Inst. of Theoretical and Experi-

mental Physics, USSR). Zh. Eksperim. i Teor. Fiz., 44: 1437-41(May 1963). (In Russian)

The spectra of neutrons produced in (d,n) reactions on Co, Fe, Ni, and Cu nuclei (natural isotopic composition) are investigated for 12.1 ± 0.4 Mev deuteron energies and a neutron emission angle of 10° (lab system). The measurements are performed with a multi-channel time analyzer in the nanosecond range. The polarization and angular distribution of neutrons of the main gross peaks for the Co (d,n) Ni and Fe (d,n) Co reactions are also investigated. In the first case the polarization value is (–11 ± 13)% for a neutron emission angle θ_n = 40° (lab system) and in the second case (+7.1 ± 1.9)% for an emission angle θ_n = 30°. The orbital angular momentum of the captured proton is found to be $l_p \geq 3$. (auth)

28336 AN ATTEMPT TO DETECT THE POLARIZATION OF RECOIL NUCLEI IN STRIPPING REACTIONS. I. I. Levintov and F. A. Pavlovskii (Inst. of Theoretical and Experimental Physics, USSR). Zh. Eksperim. i Teor. Fiz., 44: 1442-4(May 1963). (In Russian)

The polarization of Li^8 nuclei from the Li^7(d,p) reaction is determined from the asymmetry of their β decay. Nuclei ejected from the target are accumulated in helium and swept by a fast stream of the gas into a strong magnetic field with well shielded counters. Depolarization of the nuclei is practically absent. Asymmetry values for two ranges of the angles of emission of the nuclei in the c.m.s. are obtained. (auth)

28337 FISSION OF URANIUM AND THORIUM INDUCED BY SUB-BARRIER DEUTERONS. G. I. Marov, Yu. A. Nemilov, Yu. A. Selitskii, and V. P. Eismont. Zh. Eksperim. i Teor. Fiz., 44: 1445-9(May 1963). (In Russian)

The fission cross sections of Th^{232}, U^{238}, U^{235}, and U^{233} by 5.8- to 6.6-Mev deuterons are measured with a semiconductor detector. For a 6.6-Mev deuteron the cross sections are respectively 1.5×10^{-28}, 1.6×10^{-28}, 7.5×10^{-28}, and 12×10^{-28} cm^2 with an accuracy of ±10%. An investigation of the kinetic energy distribution of the fragments and an analysis of the fission cross section data indicate that Th^{232} and U^{238} undergo fission mainly after deuteron capture, and that in not less than 70% of the cases the stripping reaction precedes U^{235} and U^{233} fission. (auth)

28338 INVESTIGATION OF THE $C^{12}(t,\alpha)B^{11}$ REACTIONS. K. Nedvedyuk, V. I. Salatskii, and I. V. Sizov (Joint Inst. of Nuclear Research, Dubna, USSR). Zh. Eksperim. i Teor. Fiz., 44: 1450-5(May 1963). (In Russian)

Differential cross sections for the reactions $C^{12}(t,\alpha_0)B^{11}$ and $C^{12}(t,\alpha_1)B^{11*}$ are measured at an angle 90° in the lab system for tritium ion energies between 0.3 and 1.2 Mev. For some energy values lying in the indicated range, angular distributions of α particles corresponding to formation of a residual B^{11} nucleus in the ground state are measured and total cross sections for the reaction are obtained. (auth)

28339 PRODUCTION OF STRANGE PARTICLES BY 2.8 Bev/c π^- MESONS ON XENON. I. A. Ivanovskaya, E. V. Kuznetsov, A. Prokesh, and I. V. Chuvilo (Inst. of Theoretical and Experimental Physics, USSR and Joint Inst. of Nuclear Research, Dubna, USSR). Zh. Eksperim. i Teor. Fiz., 44: 1456-62(May 1963). (In Russian)

The relative and absolute cross sections of different channels for strange particle production by π^- mesons with 2.8 Bev/c momentum on xenon nuclei are measured. The angular and momentum distributions of strange particles in the laboratory system and π meson-nucleon center of mass system are presented. (auth)

28340 METHOD OF TEMPERATURE GREEN FUNCTIONS AND THE THEORY OF THE MÖSSBAUER EFFECT ON IMPURITY NUCLEI. I. P. Dzyub and A. F. Lubchenko (Inst. of Physics, Academy of Sciences, Ukrainian SSR). Zh. Eksperim. i Teor. Fiz., 44: 1518-24(May 1963). (In Russian)

The probability f of the Mössbauer effect for an impurity nucleus in a solid solution, as well as the temperature shift δE of the Mössbauer line, are determined by the temperature Green function method. General equations are derived which define f and δE in terms of the parameters of an ideal solvent lattice and the mass ratio of the impurity and crystal-solvent atoms and also a parameter characterizing the interaction between the impurity atom and solvent atoms. Concrete calculations are performed for a monatomic cubic crystal-solvent in the Debye approximation. The calculated values of f and δE are compared with experimental data. (auth)

28341 π MESON PRODUCTION BY HIGH ENERGY μ MESONS IN THE FIELD OF THE NUCLEUS. A. V. Berkov and Yu. P. Nikitin. Zh. Eksperim. i Teor. Fiz., 44: 1590-2 (May 1963). (In Russian)

Coulomb and diffraction mechanisms of π meson production by high energy μ mesons on nuclei in the reaction $\mu + A \rightarrow \pi + \nu + A$ are considered. It is shown that the diffraction mechanism yields a reaction cross section that exceeds the Coulomb mechanism by two orders of magnitude. (auth)

28342 CONDITIONS OF FORMATION OF μ^+ MESIC MOLECULES. A. M. Brodskii (Inst. of Petroleum Chemistry, Academy of Sciences, USSR). Zh. Eksperim. i Teor. Fiz., 44: 1612-17(May 1963). (In Russian)

The formation of μ^+ mesic molecules as a result of reactions between muonium and organic molecules is considered. The experimental conditions in which it should be possible to observe μ^+ mesic molecules and μ^+ mesic radicals are determined, and a possible method for their observation is indicated. (auth)

28343 PROBABILITY OF ISOMERISM IN THE STATISTICAL MODEL OF THE NUCLEUS. V. M. Strutinskii. Zh. Eksperim. i Teor. Fiz., 44: 1719-22(May 1963). (In Russian)

The isomerism probability for a certain nuclear level is estimated on basis of the statistical model of the nucleus. It is shown that the isomerism probability is relatively great for states with angular momenta close to the maximal value possible for a given excitation. The problem of the nature of such states and of the conditions which permit their observation is discussed. (auth)

28344 NUCLEAR PHYSICS. Robert A. Howard. Belmont, Calif., Wadsworth Publishing Co., Inc., 1963. 588p.

The historical development and concepts in the field of nuclear physics are presented. The topics covered include the birth of nuclear physics, the nuclear atom, interaction of charged particles with matter, nuclear radiation detection methods, nuclear energy levels, neutrons, beta decay, electromagnetic radiation, nuclear structure, collision dynamics, and high-energy physics. Appendices on charged-particle accelerators, nuclear reactors, potential barrier penetration, and Coulomb scattering of alpha particles are also included. (C.E.S.)

28345 ON THE INTERACTION BETWEEN ATOMIC NUCLEI AND ELECTRONS. H. B. G. Casimir. A Series of Books in Physics. San Francisco, W. H. Freeman and Co., 1963. 106p. $2.00.

The theory of hyperfine structure of atomic energy lev-

els that arises from the electric and magnetic interaction of the nucleus with its orbital electrons is presented. Information on octupole magnetic moments of the nucleus is also included. Elementary formulation of the problem of nucleon-electron interaction is presented and developed systematically. Some considerations on nuclear structure are discussed. (C.E.S.)

28346 EFFECTS OF ANGULAR MOMENTUM ON THE EXCITATION FUNCTIONS OF HEAVY ION NUCLEAR REACTIONS. Theodore James Klingen. Thesis, Tallahassee, Florida State Univ., 1962. 106p.

The excitation functions of several heavy-ion-induced nuclear reactions were studied using radiochemical techniques to obtain information on the effects of high angular momentum in compound-nucleus reactions. In this investigation, the xn, p(x-1)n, and α(x-4)n products were measured from the bombardment of Te^{128} with C^{12}, Te^{130} with C^{12}, and Sn^{124} with O^{16}. The xn excitation functions from the C ion reaction with Te fitted in shape the curves calculated from the Jackson Model, using nuclear temperatures of 2.0 to 2.8 Mev. In the case of the xn excitation functions from the reaction of Sn-124 with O-16, the excitation function curves were much wider than the Jackson Model curves. The nuclear temperatures for the Sn-O system were of the order of 1.9 Mev. This higher nuclear temperature was shown to be an effect of the high angular momentum of the compound nucleus. An explanation based on the relative deformations of the compound nuclei formed in these reactions was proposed to explain the differences between the Te-C reactions and the Sn-O reactions. The p(x-1)n excitation functions and the xn excitation functions are best understood on the assumption that they occur via a compound-nucleus mechanism. The large maximum cross sections in the α(x-4)n excitation functions as compared with either the xn or p(x-1)n excitation functions were found to be best interpreted on the basis of a direct interaction mechanism. However, the nature of the experimental method employed in this study was such that the mechanism for charged particle emission could not be definitely established. (Dissertation Abstr.)

Particle Accelerators

28347 (BNL-7120) FOCUSING OF SECONDARY BEAMS FROM THE AGS. R. M. Sternheimer (Brookhaven National Lab., Upton, N. Y.). Feb. 12, 1959. Contract [AT(30-2)-Gen-16]. 9p.

Calculations were made on the double focusing of secondary beams by two quadrupole magnets to determine the dependence of the solid angle subtended at the object on the length of the magnets for a fixed particle momentum. The curves obtained with equal image and object distances for a momentum of 10 Bev/c and for three magnet separations can be made to apply for arbitrary momenta by proper scaling of each quantity. (D.C.W.)

28348 (MATT-161) THE VARIATION OF NEUTRAL DENSITY WITH TIME IN C-STELLARATOR DISCHARGES. D. J. Grove and W. Stodiek (Princeton Univ., N. J. Plasma Physics Lab.). Dec. 1962. Contract AT(30-1)-1238. 13p.

Experiments performed on the Model C stellarator at magnetic fields between 9 and 35 kgauss and at a hydrogen pressure corresponding to 1×10^{13} molecules/cm^3 showed that the neutral atoms and molecules that appear after ionization result from a return of particles previously lost to the wall, not from the volume itself. After ionization the plasma was held at 1 ev, and pulses of ohmic heating current were periodically passed through it. The increase in plasma density corresponded to the neutral density. The percentage return of neutral atoms and incident ions from the walls was also noted to be small for several millisec, and the neutral atoms appeared to stick for 5 to 8 millisec. (D.C.W.)

28349 (NIRL/R/4) MEASURING APPARATUS AND METHODS USED DURING THE DESIGN AND COMMISSIONING OF THE NIMROD MAGNET. D. A. Gray, M. R. Harold, P. F. Jones, R. H. C. Morgan, J. E. Partington, and I. C. Pyle (Gt. Brit. National Inst. for Research in Nuclear Science. Rutherford High Energy Lab., Chilton, Berks, England). Jan. 1963. 56p.

Methods for measuring the magnetic characteristics of models and of the actual Nimrod magnet have included the use of digital computers for data processing. These methods are described along with the apparatus used. Results are given. (auth)

28350 STUDY OF THE IDEAL POLAR SURFACES REQUIRED BY NUCLEAR APPARATUS WITH WEAK OR STRONG FOCUSING. C. C. Iliescu (Inst. of Atomic Physics, Bucharest). Acad. Rep. Populare Romine, Studii Cercetari Fiz., 14: 41-55(1963). (In Rumanian)

A polar surface is considered ideal when it is equipotential at infinite distance and allows the production, in the median plan, of the specific magnetic induction in nuclear apparatus with weak or strong focusing. The final polar surface, at infinite distance, can be obtained by modifying the boundaries of the ideal polar surface, experimentally or by the relaxation method. The general analytical expression of the ideal polar surface and simpler formulas necessary in current practice were established as a function of the principal parameters of the apparatus and of the calculation error permitted. The same expressions are valid both for strong- and weak-focusing particle accelerators and for devices used for the dispersion of charged particles. In order to illustrate the method, it is shown that the equations of ideal polar surfaces are applicable to strong- or weak-focusing devices (particle accelerators and spectrometers). (tr-auth)

28351 A PROTON ELECTROSTATIC ACCELERATOR. Ming-han Yeh, Liang-fang Sun, Chen-ming Shyu, et al. Wu Li Hsueh Pao, 19: 60-9(Jan. 1963). (In Chinese)

A proton electrostatic accelerator of the high pressure type is described. The protons accelerated by this accelerator have a maximum energy of 2.3 Mev. It was in operation for more than four years. (auth)

28352 ELECTRON PACKETS OF A MICROTRON. V. P. Bykov (Inst. of Physics, Academy of Sciences, USSR). Zh. Eksperim. i Teor. Fiz., 44: 1425-8(May 1963). (In Russian)

The dimensions of electron packets in a microtron are studied. The results qualitatively agree with numerical calculations carried out on a computer. (auth)

28353 STROITEL'NYE KONSTRUKTSII USKORITELEI. (Building Constructions for Accelerators). A. N. Komarovskii. Moscow, State Publishing House, 1961. 136p.

Basic ideas on the construction of buildings to house accelerators are presented. Information on the choice of sites for the building and basic design specifications are given. Foundations under the accelerator to prevent settling are discussed. Fundamental ideas on accelerator arrangements and protective walls and covering are considered. Protective walls and doors for the accelerator building itself are discussed. (C.E.S.)

28354 AUXILIARY EQUIPMENT USED WITH THE COSMOTRON (Engineering Materials). (Brookhaven National Lab., Upton, N. Y.). 38 units. (CAPE-990).

Auxiliary equipment used with the Brookhaven Synchro-

tron or Cosmotron consists of targets, monitors, and power supplies. Included in the targets are the following: 1.5 × 6 in. D_2, 4 × 7.75 in. H_2, 4 × 12 in. H_2, 4 × 20 in. LH_2, 4 × 20 in. LH_2 Mylar, 4 × 24 in. LH_2, 4 in. × 48 in. LH_2, and a 6 × 30 in. LH_2. There is a liquid H_2 Dewar probe and a 45 liter H_2 target Dewar. The monitors include a monitor made of Be metal, an ionization chamber, and a spark chamber. The Be monitor has an air operated indexing table and an internal Co source. The ionization chamber is housed in an acrylic cast tube 4.5 in. long and 8.75 in. OD. The spark chamber is used with H_2 targets. Also included is a liquid level indicator. (F.E.S.)

28355 IMPROVEMENTS IN ION ACCELERATORS. Siegfried Klein and Jacques Pottier (to Commissariat à l'Energie Atomique). British Patent 927,938. June 6, 1963. Priority date Nov. 25, 1958, France.

A linear electrostatic ion accelerator utilizing a tubular chamber in which a series of electrodes partly permeable to the ions are disposed behind one another is described. Each electrode is connected through a resistor (about 1 megohm) to a high d-c voltage source (tens of kv). Either negative or positive heavy ions can be accelerated to very high energies since the potential of each electrode reduces almost to zero when the ion bunch hits it. The apparatus is also self-regulating. (D.C.W.)

28356 CHARGED PARTICLE BEAM-VIEWING ARRANGEMENT. Peter H. Rose (High Voltage Engineering Corp.). U. S. Patent 3,094,615. June 18, 1963. Filed Aug. 24, 1959.

An apparatus is designed for viewing and measuring a charged-particle beam produced in an accelerator. The apparatus comprises a fluoresible target (e.g., a quartz slab) and a Faraday cage mounted in the beam path so that a 90° rotation of a lever moves either the target or cage into the beam path while moving the other out of the path. A transparent wall is provided for viewing the target, and the Faraday cage is connected to a microammeter for recording the beam current. (D.L.C.)

Plasma Physics and Thermonuclear Processes

Refer also to abstracts 27539, 27540, and 27650.

28357 (AD-290086) STUDY OF TECHNIQUES FOR A HIGH POWER, FAST WAVE PLASMA CYCLOTRON AMPLIFIER. Second Quarterly Interim Engineering Report. Edwin Langberg, James L. Burkhardt, Richard L. Smith, B. Maiken Naylor, and Paul Freyheit (Elcon Lab., Inc., Watertown, Mass.). Nov. 20, 1962. Contract AF-33(657)-8852. 31p.

The conditions that must be satisfied to maintain the required electron distribution were investigated. The analysis was directed toward defining the conditions for amplification in terms of nonlinear d-c plasma properties. Possible configurations of the cyclotron r-f field and the pumping d-c field were examined, and relations tieing the cyclotron amplification to non-linear plasma behavior for a single electric field component were derived. The behavior of electrons in a gas mixture was analyzed in terms of an "average electron" model. An oscillator tube designed to verify the conclusions of the theoretical study is described. (D.C.W.)

28358 (ARL-63-62) INTERACTION OF RADIATION AND MATTER IN A PLASMA. Ludwig Oster (Yale Univ., New Haven). Feb. 1963. Contract AF33(657)-7271. 16p.

Part of a theoretical investigation of the absorption and emission of radiation by a fully ionized plasma in a magnetic field is described. Specifically, the bremsstrahlung radiation and departures from local thermodynamic equilibrium are discussed. (auth)

28359 (CLM-R-3) THE LIFE HISTORY OF IMPURITY ATOMS IN A PLASMA POSSESSING A TIME VARYING ELECTRON TEMPERATURE AND DENSITY. G. D. Hobbs and M. A. Rose (United Kingdom Atomic Energy Authority. Research Group. Culham Lab., Culham, Abingdon, Berks, England). Mar. 1963. 26p.

The differential equations describing the life history of an impurity atom in a plasma, through all its stages of ionization, require a numerical solution if the electron density and temperature vary in time in an arbitrary manner. An outline is given of some of the physical processes that can be represented by these equations; a method of solution, for which a computer program was written; and, in the form of a simple example, the type of problem for which a solution can be obtained. Such calculations are of interest since they enable a cross-check to be effected between measurements of electron temperature and density and observed impurity spectra. (auth)

28360 (JPL-TR-32-417) PROBE MEASUREMENTS OF THE DISCHARGE IN AN OPERATING ELECTRON BOMBARDMENT ENGINE. William B. Strickfaden and Kenneth L. Geiler (California. Inst. of Tech., Pasadena. Jet Propulsion Lab.). Apr. 19, 1963. Contract NAS 7-100. 26p.

Current-voltage characteristics are obtained from Langmuir probes at various positions inside a Kaufman-type ion motor. Data are presented for the engine in static (no beam, but plasma) and operating (160-ma beam) conditions. The analysis of the probe data indicates that the electrons in the plasma possess a non-Maxwellian distribution of energies. To obtain plasma properties from the probe curves, the non-Maxwellian energy distribution is assumed to consist of a primary monoenergetic group of high-energy electrons plus the usual Maxwell distribution. Working from this assumption the probe curves are analyzed for primary and Maxwell energies and densities, and the data for radial positions inside the engine are presented. It is shown from the density curves that the primary electrons are the principal source of ion production. The beam current as calculated from probe data near the exit grids agrees to the correct order of magnitude with the measured value. (auth)

28361 (NP-12921) BIBLIOGRAPHY ON PLASMA PHYSICS. N. Robert Nilsson, comp. (Uppsala Univ. Inst. of Physics). Dec. 1960. 337p.

References to articles on plasma physics and controlled thermonuclear research are presented. The references are arranged under appropriate subject headings under which they are classified as either experimental or theoretical. Areas covered are fundamental processes in gases and plasmas; gas discharges; plasma physics; magnetohydrodynamics; plasma diagnostics; plasma production, heating, and confinement (and technical applications); and technology of plasma equipment. (D.C.W.)

28362 (NP-12935) THE USE OF A COAXIAL GUN FOR PLASMA PROPULSION. Final Report. R. H. Lovberg, B. Hayworth, and T. Gooding (General Dynamics/Astronautics. Space Science Lab., San Diego, Calif.). [1962]. Contract NAS-5-1139. 93p.

Aspects of space propulsion that led to the consideration of a coaxial version of the rail gun for an experimental program on magnetohydrodynamic propulsion are reviewed.

Selection of circuit parameters and the operational mode for the guns is discussed, and the experimental program aimed primarily at measuring plasma phenomena in the gun is described. Four guns described, each incorporating parameter changes, were tested. A combination of electric and magnetic probing was used to determine the field and ion distributions (shown) in the guns. Experiments were also performed on the deflection of a pendulum by the emitted plasma. The results are discussed, and it is shown that plasma acceleration by $\vec{J} \times \vec{B}$ forces does not generally occur in "snowplow" fashion, but rather through momentum transfer from an ionizing current wave that moves through the plasma. (D.C.W.)

28363 (UCRL-6981-T(Rev.I)) A NOTE ON THE MAXIMUM BOUND PRINCIPAL QUANTUM NUMBER. Carl A. Rouse (California. Univ., Livermore. Lawrence Radiation Lab.). July 1962. Contract [W-7405-eng-48]. 10p.

A semi-classical formulation of the problem of the maximum bound principal quantum number is presented in terms of the radial distribution function for the free particles of an ion atmosphere. Using the charge distribution for a classical Debye atmosphere, it is shown that the maximum bound principal quantum number is essentially the same whether one considers the excited electron moving in the ion atmosphere or in a constant central potential due to this same ion atmosphere. (auth)

28364 (UCRL-7294) A HEATING MECHANISM FOR A PLASMA. Daryl D. Reagan (California. Univ., Livermore. Lawrence Radiation Lab.). Apr. 11, 1963. Contract W-7405-eng-48. 9p.

A sinusoidal fluctuation in magnetic field can gradually heat a uniform plasma. This effect is discussed from the standpoint of Boltzmann's equation, including some effects of collisions, for frequencies that are low compared to plasma and cyclotron frequencies. Application to the problem of an electron-ion plasma with radiation loss is mentioned. (auth)

28365 (UCRL-10801) DIFFUSION FROM A LINE SOURCE IN A MAGNETIC FIELD. Klaus H. Berkner, Robert V. Pyle, Henry F. Rugge, J. Warren Stearns, and Joseph Winocur (California. Univ., Berkeley. Lawrence Radiation Lab.). June 20, 1963. Contract W-7405-eng-48. 16p.

Electron and ion temperatures and densities were measured with Langmuir probes and by the absorption of optical radiation in a strontium-seeded argon plasma produced by a 10- to 40-amp discharge from an oven with a hollow cathode into a 30-cm long, 20-cm diameter conducting cylinder with conducting end plates. Rubidium light at 4215 Å, coincident with a principal line of singly ionized Sr, was transmitted through the plasma, and the amplitude and line shape were measured with a scanning Fabry-Perot interferometer to obtain ion temperatures. The axial density variation was approximately cosinusoidal. (auth)

28366 MAGNETIC INDUCTION PARAMETER FOR LORENTZ ACCELERATORS. Herbert Beckmann (Rice Univ., Houston, Tex.). AIAA (Am. Inst. Aeron. Astronaut.) J., 1: 1434(June 1963).

Equations for the proper amount of magnetic induction in Lorentz accelerators are derived, based on the hypothesis that secondary effects become significant when high efficiencies in the energy conversion process are attempted. The optimum amount of magnetic induction can be determined directly from the change of available electric energy into kinetic energy of the working fluid. The electric power input per unit cross section area of the accelerator is equal to or greater than the increase in kinetic energy of the working fluid plus the power required to increase its degree of ionization. (C.E.S.)

28367 MEASUREMENT OF PLASMA DENSITY USING A GAS LASER AS AN INFRARED INTERFEROMETER. D. E. T. F. Ashby and D. F. Jephcott (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Appl. Phys. Letters, 3: 13-16(July 1, 1963).

A He–Ne gas laser is used as a simple infrared interferometer for measuring electron densities. The optical cavity of the laser corresponds to the reference arm of conventional interferometers. Interference occurs if the radiation from the laser is reflected back into the laser by an external mirror. The system was used to measure the electron density in an argon plasma produced by a pulsed high-current gas discharge. (C.E.S.)

28368 MOTION OF A VISCOUS, INCOMPRESSIBLE, WEAKLY ELECTRIC CONDUCTIVE FLUID OUTSIDE A MAGNETIZED SPHERE. Giorgio M. Ferrero (Instituto di Fisica Sperimentale del Politecnico, Turin). Atti Accad. Sci. Torino. I. Classe Sci. Fis., Mat. Nat., 97: 513-33 (1962-63). (In Spanish)

By reference to the basic equations of magnetohydromechanics, simplified by suitable hypotheses, the magnitude of the motion of a viscous current is considered, and the magnetic field is calculated from the field functions. The velocity is determined from the current functions and the pressure. (tr-auth)

28369 RADIATION FROM A CURRENT FILAMENT CLAD BY AN ANISOTROPIC PLASMA SHEATH. Yujiro Ohba (National Research Council, Ottawa). Can. J. Phys., 41: 858-62(June 1963). (NRC-7370)

The radiation field from a plasma-clad filament carrying a current $I_0 \exp(-jk_z z + j\omega t)$ is calculated. The plasma, which is finite in thickness, is magnetized in the direction parallel to the current filament. The field outside the plasma sheath is expressed by a combination of TE and TM modes, and in general the field is elliptically polarized. The conditions for circular and linear polarization in the far field are related to the thickness of the plasma sheath and the wave constants of the plasma. (auth)

28370 PENETRATION OF A NEUTRALIZED ION-ELECTRON BEAM INTO A MAGNETIC BARRIER. CONDITIONS AFFECTING THE HEIGHT OF THE BARRIER. Jean-Michel Dolique. Compt. Rend., 256: 3984-7(May 6, 1963). (In French)

One of the solutions envisaged for filling a magnetic bottle with a hot plasma is the injection of a high energy ion beam (≃100 kev) and then its disorganization inside the bottle. One part at least of the ions is then trapped in the bottle; the ordered kinetic energy possessed by the beam is then transformed into the thermal disordered energy desired (100 kev ≃1 billion °K). But, if the ions can be trapped, their radius of gyration is small because of the dimensions of the bottle ($\rho_i \simeq 5$ mm for 100-kev protons). Only the incident ions cannot penetrate; they are reflected. It was thought to avoid this difficulty by neutralizing the ion beam with the aid of electrons. The penetration of the neutralized beam in a magnetic barrier with gradient is analyzed theoretically. The necessary conditions of penetration are given, relating the parameters which define the beam (density $n_i = n_e = n$, velocity $v_i = v_e = v$, and geometric dimension), at the height B_0 of the magnetic barrier. (tr-auth)

28371 THE FLOW OF A CONDUCTING GAS IN THE PRESENCE OF THIN PROFILES. Lazare Dragos (Uni-

versité, Bucharest). Compt. Rend., 256: 4158-61(May 13, 1963). (In French)

The flow of a highly ionized, compressible gas around thin profiles in the presence of a magnetic field is considered under conditions of the appearance of surface currents. (J.S.R.)

28372 PENETRATION OF A NEUTRALIZED ION-ELECTRON BEAM IN A MAGNETIC BARRIER. CONDITION AFFECTING THE GRADIENT OF THE MAGNETIC FIELD. Jean-Michel Dolique. Compt. Rend., 256: 4170-2(May 13, 1963). (In French)

In order to study theoretically (by an analysis of individual trajectories) the penetration of a neutralized ion-electron beam in a magnetic barrier, the conditions necessary for penetration, relating the parameters defining the beam (density $n_i = n_e = n$, velocity $v_i = v_e = v$, geometric dimensions) to the height B_0 of the magnetic barrier were established previously (Compt. rend. 256, 3984(1963)). The study of electron oscillations shows a new condition affecting the length g of the magnetic field rise. It is assumed, as previously, that $g \ll \rho_i$ (radius of gyration of the ions in B_0), and the discussion is centered on the first penetration phase of the neutralized beam, the electron "thinning" phase. (tr-auth)

28373 TE_{omn} MODES OF A QUASI-CO-AXIAL RESONANT CAVITY. Roger Howard, F. L. Curzon, and E. R. Powell (Univ. of British Columbia, Vancouver). J. Electron. Control (1), 14: 513-22(May 1963). (In English)

The geometrical similarity between a z-pinch device and a co-axial resonant cavity is noted, and the expected variations in the resonant spectrum of such a cavity produced by distortion of the central conductor are calculated, with a view to using such variations to study instabilities in pinch discharges. The calculations are restricted to the TE_{omn} modes since these are the only modes which can be excited in a z-pinch device; the results are presented in terms of dimensionless parameters so that they may readily be applied to any practical system. (auth)

28374 ELECTROSTATIC RESONANCES OF HOLLOW PLASMAS. F. W. Crawford (Stanford Univ., Calif.). J. Nucl. Energy, Pt. C, 5: 69-72(Mar.-Apr. 1963). (In English)

Multipole resonances of plasma columns supported in free space can be predicted under quasi-static assumptions and were often observed experimentally. In the case of hollow discharges, double-resonances having frequency ratios agreeing well with theoretical predictions were indicated. If the resonances are to be used to determine electron number density and its variation in the plasma, a more refined theory of the resonances is required than that assuming constant density. The main difficulty is that the potential distribution in the plasma is unknown. It is shown how this can be circumvented by application of a variation principle that allows a formulation of the resonant frequencies to be made that is independent of the particular potential distribution in the plasma. (auth)

28375 LOW-FREQUENCY WAVES IN AN UNBOUNDED PLASMA. T. E. Stringer (United Kingdom Atomic Energy Authority, Abingdon, Berks, Eng.). J. Nucl. Energy, Pt. C, 5: 89-107(Mar.-Apr. 1963). (In English)

A comprehensive treatment of the propagation of low-frequency plane waves in a low β, homogeneous plasma in a magnetic field is based on the two fluid equations without collision terms. The treatment covers the three lower frequency branches of the complete dispersion curves, extending up to the electron cyclotron frequency. Dispersion curves for propagation at an angle to the magnetic field are given for representative parameters, and simple expressions tabulated for the electric field polarization and the electron and ion mean velocities along each section of these curves. The physical reasons for the changes in these quantities with increasing wavenumber are discussed for each of the three branches. (auth)

28376 MEASUREMENT OF THE CONCENTRATION OF THE 'HOT' COMPONENT OF A PLASMA. Yu. L. Sokolov, E. A. Al'bitskaya, and E. I. Karpushkina (Kurchatov Inst. of Atomic Energy, Moscow). J. Nucl. Energy, Pt. C, 5: 109-13(Mar.-Apr. 1963). (Translated from Russian by D. L. Allan)

The possibility of using free probes in the form of minute metallic spheres (diameter ~15 μ and ~1 mm), which could be dropped through the volume occupied by the plasma, for the diagnosis of a plasma in a stationary state, was investigated. The concentration of the hot component of the plasma could be studied by observing the heating of the spheres occurring as a result of their bombardment by fast ions and electrons. By studying the trajectories of the spheres it was possible to determine the magnitude and sign of the electrical charge that they carried and also to find the configuration and intensity of the electric fields within the trap under various machine operating conditions. (auth)

28377 RENORMALIZATION CONSTANT OF ELECTRON GAS. Yukio Osaka (Tohoku Univ., Sendai). J. Phys. Soc. Japan, 18: 652-60(May 1963). (In English)

An evaluation is carried out for the renormalization constant Z of an interacting electron gas. It is shown that the lowest approximation with respect to effective interaction between electrons leads to Daniel and Vosko's result for Z, while higher order correction for Z modifies their result appreciably and their result is not correct even in the limit of high density. (auth)

28378 PINCH MOTION OF A CYLINDRICAL PLASMA. Keishiro Niu (Tokyo Univ.). J. Phys. Soc. Japan, 18: 708-12(May 1963). (In English)

The self-pinch motion of a cylindrical plasma is analyzed by using the two-fluid model of electrons and ions. The Lorentz force caused by currents flowing through the plasma along the cylindrical axis acts only on the electrons, because most part of the current is carried by the electrons. Thus the charges are separated and the electric field is induced in the radial direction. The ions are accelerated secondarily by this electric field. As the initial rate of increase of the currents increases and the plasma density decreases, the charge separation becomes greater. Depending on the magnitudes of these quantities the motions are classified into two types, namely the thorough charge separation and the plasma oscillation after the separation. Numerical examples show that the behaviors of the plasma are different from the result obtained by the one-fluid model. (auth)

28379 SIMILARITY SOLUTIONS FOR TRANSIENT PINCHED PLASMA. Sinzi Kuwabara (Tokyo Univ.). J. Phys. Soc. Japan, 18: 713-18(May 1963). (In English)

Hydrodynamic theory of transient pinched plasma is presented. The study is concerned with the case in which a cylinder of a perfectly conducting plasma is compressed by an extremely strong magnetic pressure induced by an impulsively applied electric current and a converging shock wave propagates into the plasma. (auth)

28380 A CHARACTERISTIC OF P.I.G. DISCHARGE TUBE. Yuji Tanaka and Kenzo Yamamoto (Nagoya Univ., Japan). J. Phys. Soc. Japan, 18: 735(May 1963). (In English)

Coherent oscillation is investigated for partially ionized

gas discharges. There are two kinds of standing wave modes of the plasma column, depending on such parameters as the ratio of the magnetic field to the plasma pressure. The plasma column forms a cylindrical resonator, and the cycloidal motions of electrons around the plasma column, that are made by the crossed electric and magnetic fields at the anode, excite a coherent oscillation with small amplitude. Characteristics of the two standing wave modes are discussed. (C.E.S.)

28381 INTERACTION OF A PLASMA STREAM WITH A THREE-DIMENSIONAL MAGNETIC DIPOLE. Nobuki Kawashima and Hiroshi Ishizuka (Tokyo Univ.). J. Phys. Soc. Japan, 18: 736-7(May 1963). (In English)

A differentially pumped coaxial plasma gun is used as a source in studies of plasma interactions with a solenoidal coil forming a three-dimensional magnetic dipole. A cavity forms when the magnetic field is applied. The size of the cavity increases with the magnetic field, and its form is almost independent of the magnetic field. Plasma penetrates the cavity along the magnetic lines of force towards the polar regions of the day-light side of the dipole and may be the same phenomenon as the observed magnetic disturbance in the polar regions on the earth. (C.E.S.)

28382 OSCILLATIONS IN P.I.G. DISCHARGE AND A TYPE OF INSTABILITY OF PLASMA. Shigeo Nagao, Akira Miyahara, Tsutomu Kuroda, Teruyuki Sato, and Kiyokata Matsuura (Nagoya Univ., Japan). J. Phys. Soc. Japan, 18: 738-39(May 1963). (In English)

An explanation is presented for the existence of hydromagnetic waves in a partially ionized gas discharge that do not damp in a weak magnetic field and tend to have a phase velocity of the sound wave in a stronger field. Equation for a low frequency oscillation with small amplitude in a plasma in a uniform magnetic field are used in the analysis. (C.E.S.)

28383 A DETECTING METHOD OF ION CYCLOTRON RESONANCE OF PLASMA. Akihiro Mori and Shigenori Hayashi (Kyoto Univ.). Japan. J. Appl. Phys., 2: 306-7 (May 1963). (In English)

The Franklin oscillator applied to a Heliotron-B magnetic field device acts as detector of ion cyclotron resonance. The oscillator has a pure sinusoidal wave form and can cover the wide frequency range with little variation of power. These characteristics make it possible to adopt a frequency plotting. (C.E.S.)

28384 ON THE THEORY OF THE INTERACTION BETWEEN CHARGED PARTICLES AND THE TOTALITY OF THE PLASMA-ELECTRONS. W. Kaufmann (Hochschule für Elektrotechnik, Abteilung Theoretische Physik, Ilmenau, Ger. and Deutsche Akademie der Wissenschaften, Jena). Monatsber. Deut. Akad. Wiss. Berlin, 5: 248-52(1963).

Plasma was treated by hydrodynamical methods. The ions in an unlimited plasma were considered as being approximately stationary and representing a uniformly diffused background. The plasma electrons were considered also to represent a continuum. In addition to electrostatic forces and electron pressure, a plasma-electron friction was also taken into consideration. With the aid of the model, the way in which a point-charge moving within the plasma influences the density distribution of the plasma electrons was studied, along with the magnitude of the resulting reversing force on the test particle. The method described provides simple mathematical operations and a good approximation of the real situation. (OTS)

28385 ENERGY EMITTED IN SPECTRAL LINES BY A PLASMA AT EQUILIBRIUM. L. M. Biberman, V. S. Vorob'ev, and G. E. Norman. Opt. Spectry. (USSR) (English Transl.), 14: 176-9(Mar. 1963).

The total energy radiated in the form of spectral lines by a hydrogen plasma at equilibrium was computed. Several of the strongest lines were treated individually. The remaining weaker lines were divided into several groups, and their contribution was computed by integral formulas. Computations were carried out for an optically thin layer and for actual conditions, in which some of the lines were reabsorbed. A comparison was made with the energy emitted by the plasma in the form of a continuous spectrum. The results obtained show that over a broad range of temperatures, pressures, and layer thickness, the lines contribute most of the energy; the total energy of all the weak lines may be of the same order as the energy of a few of the stronger lines. (auth)

28386 THE PHOTOGRAPHY OF ARGON PLASMAS. D. C. Smith, M. G. Briscoe, T. P. Anderson, and Ali Bulent Cambel (Northwestern Univ., Evanston, Ill.). Photo. Sci. Eng., 7: 177-82(May-June 1963).

Photographic techniques used in plasma physics and other high-temperature gas dynamic experiments are discussed. These include discussions and examples of black-and-white and color still pictures of supersonic plasmas, high-speed motion pictures of the arc process, black-and-white and color schlieren photography of subsonic plasmas. The various films, filters, and exposure indices required for photography of intense plasmas are given. Photographic methods of obtaining qualitative and quantitative information of plasma phenomena are discussed. (auth)

28387 APPLICATION OF THE TWO-PARTICLE DISTRIBUTION FUNCTION TO ESTIMATE THE COLLISIONAL DAMPING OF PLASMA OSCILLATIONS. J. M. Burgers (Univ. of Maryland, College Park). Phys. Fluids, 6: 889-97(July 1963).

An approximate, linearized equation for the pair correlation function, containing a Debye potential instead of the Coulomb potential, is used to derive by direct integration a solution for the pair correlation function for the case of long-wavelength plasma oscillations in a fully ionized gas without a magnetic field. The correlation function is then applied to describe the effect of collisions in a linearized Boltzmann equation for the single-particle distribution function, which again is integrated directly. By substituting the integral of the single-particle function over the velocity space into Poisson's equation for the electric field, a dispersion equation is constructed for the oscillations. From this dispersion equation the damping of the oscillations can be found. The result combines the Landau damping with the collisional damping. Direct integration in coordinate space, without introducing Fourier and Laplace transforms and without integrations in a complex plane is demonstrated. Only the most interesting terms were considered. The results obtained are not essentially different from these derived by other methods. (auth)

28388 HAMILTON'S VARIATIONAL PRINCIPLE FOR A PERFECTLY CONDUCTING PLASMA CONTINUUM. T. S. Lundgren (Univ. of Minnesota, Minneapolis). Phys. Fluids, 6: 898-904(July 1963).

Hamilton's principle with a Lagrangian density consisting of kinetic energy minus the sum of internal and magnetic energy is used to derive the momentum equation and the pressure jump condition for a compressible nondissipative plasma continuum. This is done for a system consisting of fluid, vacuum, and perfectly conducting solid parts by varying the fluid particle paths subject to conservation of

mass, conservation of entropy, and the Gallilean invariant form of Maxwell's equations. This is done also in Eulerian form for a purely fluid system using Lin's additional constraint. (auth)

28389 THE INTERCHANGE INSTABILITY IN THE STELLARATOR. Russell M. Kulsrud (Princeton Univ., N. J.). Phys. Fluids, 6: 904-13(July 1963).

The interchange instability is studied in an equilibrium similar to that of a stellarator with helical windings, on the basis of combined Maxwell and Vlasov equations in the limit of small particle gyration radii. However, the first correction in the size of these radii and its effect on the stability criterion is studied. It is found that the stability criterion may be expressed in terms of the growth rate s_H of the zero-gyration-radius theory. The stability is always improved by this correction and the new stability criterion is given by $s_H/\Omega < ma^2/R^2$, where Ω is the ion gyration frequency, a the ion gyration radius, R the radius of the plasma, and m the azimuthal wavenumber. The zero-gyration-radius normal mode equation and growth rates are then found and these are applied to the special case of helical windings with trefoil symmetry. It is shown that even when the gyration radius is small its effect may be significant, in many cases increasing the plasma pressure that may be stably confined by a factor of 2 or more. (auth)

28390 WAVE PROPAGATION IN A TUBULAR PLASMA. L. S. Napoli and G. A. Swartz (RCA Labs., Princeton, N. J.). Phys. Fluids, 6: 918-24(July 1963).

The configuration consisting of a dielectric rod, surrounded by a plasma shell and a concentric outer conducting cylinder, is investigated theoretically and experimentally for its propagation characteristics. It is predicted from the theory that such a configuration will support propagation in a backward wave mode. These backward waves were observed in experiments using an essentially identical configuration with the plasma provided by a cesium discharge. Agreement between these observations and calculations is excellent. A forward wave was also observed at low frequencies, and is attributed to the influence of the sheath at the plasma-conductor interface. The observed dispersion curve for this forward wave is also in good agreement with that calculated using the expected sheath size of the cesium plasma-metal interface. (auth)

28391 HYDROMAGNETIC WAVE PROPAGATION NEAR ION CYCLOTRON RESONANCE. Forrest I. Boley, John M. Wilcox, Alan W. DeSilva, Peter R. Forman, Gordon W. Hamilton, and C. N. Watson-Munro (Univ. of California, Berkeley). Phys. Fluids, 6: 925-31(July 1963). (UCRL-10381)

A torsional hydromagnetic wave is induced by application of an oscillatory radial electric field to one end of a cylindrical deuterium plasma located in a magnetic mirror field. The wave propagates in the axial direction to the center of the device, where a resonance occurs between the hydromagnetic wave frequency and the local ion cyclotron frequency. Wave magnetic-field measurements indicate that transfer of power from the 1-Mw, 8.3-Mc oscillator to the hydromagnetic wave is about 65% efficient, and that more than 90% of the wave energy is transferred out of the wave at the resonance region. (auth)

28392 EQUILIBRIUM OF A CURRENT-CARRYING TOROIDAL PLASMA. Shoichi Yoshikawa, Rolf M. Sinclair, John O. Kessler, and Wynford L. Harries (Princeton Univ., N. J.). Phys. Fluids, 6: 932-7(July 1963).

A current-carrying plasma confined in a smooth toroidal magnetic field tends to expand due to the nonuniformity of the field and the self-interaction of the current. This expansion can be nullified, in the absence of externally imposed rotational transform, by means of a vertical magnetic field. Macroscopically considered, such a vertical magnetic field interacts with the ohmic heating current to supply an inward ponderomotive force. The magnitude of the plasma expansion tendency and of the vertical field required to achieve steady state conditions is derived. It is also demonstrated that if the plasma configuration is determined by an aperture limiter, helical fields are equivalent to an applied vertical field, insofar as the plasma equilibrium is concerned. (auth)

28393 ON EQUILIBRIUM OF A CURRENT-CARRYING TOROIDAL PLASMA. II. EXPERIMENTS WITH THE MODEL C STELLARATOR. Rolf M. Sinclair, Shoichi Yoshikawa, Wynford L. Harries, and John O. Kessler (Princeton Univ., N. J.). Phys. Fluids, 6: 937-45(July 1963). (MATT-165)

A series of experiments with the model C stellarator showed that a previously detected asymmetry in the device could be removed by applying such a magnetic field B_T, transverse to the main confining magnetic field, that an inherent lack of closure of the flux lines of the confining field was removed. The symmetrized stellarator was then used to demonstrate that an equilibrium could be achieved in the plasma by applying a uniform magnetic field transverse to the plane of the stellarator. With current I_{OH} flowing toroidally in the plasma, the tendency for the toroid to expand, due to the hoop force and the U-bend drift, is counterbalanced by the $I_{OH} \times B_T$ force. The observed transverse field required for equilibrium is in good agreement with the value predicted theoretically. Improvement at equilibrium of such plasma parameters as electron temperature, particle confinement time, and energy replacement time is demonstrated. (auth)

28394 OSCILLATIONS IN SYNTHETIC PLASMA BEAMS. W. Bernstein and J. M. Sellen, Jr. (Space Tech., Labs., Inc., Redondo Beach, Calif.). Phys. Fluids, 6: 1032-3(July 1963).

Oscillations, associated with a rapid, non-collisional electron thermalization, were detected under specific conditions in a synthetic plasma beam. Experimental observations indicate that plasma oscillations only occur when the injected electron energy is greater than about twice the plasma electron thermal temperature, in reasonable agreement with two-stream instability theories. The ions were generated by contact ionization of cesium on a hot planar tungsten surface. The electrons were injected through a potential developed between the plasma and neutralizer. Oscillation frequencies were plotted as a function of the square root of the total ion current. (C.E.S.)

28395 MOTION AND STRUCTURE OF A PLASMA PRODUCED IN A RAIL SPARK GAP. L. Liebing (Institut für Plasmaphysik, Garching, Ger.). Phys. Fluids, 6: 1035-?(July 1963).

An argon plasma was produced in the rail spark gap at initial pressures of 20 to 3000 μ Hg. The velocity of the luminosity front and of the particles was investigated. The shape of the current sheet was discussed and a correlation with luminosity was made. (C.E.S.)

28396 THREE-DIMENSIONAL CONTAINMENT OF CHARGED PARTICLES BY ORTHOGONAL STANDING WAVES. A. R. Shapiro and W. K. R. Watson (Motorola Inc., Riverside, Calif.). Phys. Rev., 131: 495-500 (July 15, 1963).

It is shown how genuine three-dimensional containment

of a single charged particle can be achieved even in the presence of a repulsive uniform space-charge distribution using three mutually orthogonal standing waves or equivalently a resonant cavity. Possible extensions of this technique to plasma containment are also discussed since it would appear that the high energies achievable with this system make it worthy of further investigation. (auth)

28397 CURRENT DENSITY IN A PLASMA IN A MAGNETIC FIELD. Hermann Poeverlein (Technische Hochschule, Munich). Z. Angew Phys., 15: 441-5(May 1963). (In German)

The current density in a plasma in a magnetic field was specified as a function of electric-field strength. This proved itself, in spite of the asymmetry of the preparation, to be advantageous for various problems in which coordinate directions play a preferred role, such as for plane waves in homogeneous plasma, for fields on boundary surfaces between two media, and for waves in layered media. The assumptions on which magnetoionic theory is based are listed. A generalization of the view of magnetohydrodynamics is presented. (M.C.G.)

28398 ON THE THEORY OF THE PROPAGATION OF ELECTROMAGNETIC WAVES IN THE DIRECTION OF AN IMPRESSED MAGNETIC FIELD FOR CYLINDRICALLY SYMMETRICAL PLASMA ARRANGEMENTS. Willi Oehrl (Technische Hochschule, Munich). Z. Angew Phys., 15: 445-53(May 1963). (In German)

Explicit solutions for the propagation behavior of electromagnetic waves in plasma were sought. The ϵ tensor and field equations are discussed. The boundary and continuity conditions are considered. The frequency shift of the propagation constant was investigated. (M.C.G.)

28399 ABSORPTION OF WAVES IN A PLASMA (QUASILINEAR APPROXIMATION). V. L. Yakimenko. Zh. Eksperim. i Teor. Fiz., 44: 1534-43(May 1963). (In Russian)

Absorption of waves in a plasma is considered for waves moving at an arbitrary angle with respect to a constant magnetic field. Interaction between the particles and waves is taken into account. As a result of the interaction the velocity distribution of the particles is modified, and this modification leads to a decay of the oscillations that differs from that calculated by the linear theory. Formulas defining the change in the distribution function and the absorption of waves of an arbitrary type are derived. The results are applied to a magnetoacoustic wave moving at an angle θ with the constant magnetic field. θ is assumed to deviate somewhat from $\pi/2$. Electron-Cherenkov, electron-cyclotron-absorption, and absorption radiation on harmonics of the ion cyclotron frequency are computed. (auth)

28400 TRANSVERSE DRIFT OSCILLATIONS OF AN INHOMOGENEOUS PLASMA. A. B. Mikhailovskii. Zh. Eksperim. i Teor. Fiz., 44: 1552-61(May 1963). (In Russian)

It is shown that in an inhomogeneous plasma in a constant magnetic field, waves exist that move across the magnetic field, whose polarization is the same as that of the ordinary wave but whose frequency is much lower than the plasma electron frequency. Such waves are localized in regions in which the plasma pressure is not uniform; their phase velocity significantly depends on the velocity of the Larmor electron drift. (auth)

28401 ON A CERTAIN TYPE OF MAGNETOHYDRODYNAMIC WAVES. L. A. Ostrovskii (Gorkii State Univ., USSR). Zh. Eksperim. i Teor. Fiz., 44: 1587-9(May 1963). (In Russian)

Nonlinear one-dimensional magnetohydrodynamic motions involving variation of the magnitude as well as direction of the transverse magnetic field are considered. Corresponding solutions for the simplest cases are obtained. (auth)

28402 ELECTRICALLY ENERGIZED SHOCK TUBES. Richard G. Fowler. Norman, Oklahoma, University of Oklahoma Research Institute, 1963. 174p.

A review is presented of the work done and the state-of-art in the field of plasma shock waves. Some experimental data are given. Some of the topics covered are the electrical behavior of gases in the driver discharge, electron-driven shock waves, breakdown waves, radiation, etc. A bibliography of 128 references is included. (D.L.C.)

28403 IMPROVEMENTS RELATING TO ELECTRICAL DISCHARGE APPARATUS. Robert Frederick Hemmings (to Associated Electrical Industries Ltd.). British Patent 929,804. June 26, 1963. Filed Sept. 21, 1960.

A toroidal container is designed for heavy electric discharges, which is applicable to thermonuclear reaction studies. The container is formed by inner and outer walls, with the outer wall of sufficient conductivity to allow stabilizing currents to flow, and the inner wall of sufficient resistance to avoid short-circuiting the discharge emf. A low vapor pressure insulating cooling liquid is circulated in the space between the inner and outer walls at a pressure intermediate to that of the discharge vacuum and the external atmospheric pressure. (B.O.G.)

28404 APPARATUS FOR INFLUENCING A FLOWING PLASMA. Ludwig Bolkow. British Patent 929,898. June 26, 1963. Priority date Feb. 19, 1960, Germany.

A method is described for controlling a plasma beam, which uses thermocouples to convert the heat radiated by the beam into electric current, and using this current to generate magnetic fields which guide or concentrate the beam. The direction and field distribution required for the external magnetic fields are ensured by adopting a suitable circuit arrangement and by arranging the thermocouples in the appropriate manner in the coil. This method enables operations with a plasma beam to be carried out continuously. (B.O.G.)

28405 ION INJECTION DEVICE FOR THERMONUCLEAR PLASMA APPARATUS. Francois Prévot (to Commissariat a l'Energie Atomique). U. S. Patent 3,093,765. June 11, 1963. Priority date Apr. 20, 1959, France.

An ion injection device composed of an annular ion source combined with an annular acceleration electrode coaxial to the source and providing a sheet-like ion beam is described. The confining magnetic field of axial symmetry is coaxial with the electrode and source, and the device gives a high intensity beam while relaxing the necessity of stabilizing the acceleration tension and the magnetic field. The device also provides rapid beam heating and high energy efficiency and allows the removal of instabilities due to anisotropic ion velocities. (D.C.W.)

28406 APPARATUS FOR CARRYING ON NUCLEAR REACTIONS. Alfred J. Gale (High Voltage Engineering Corp.). U. S. Patent 3,094,474. June 18, 1963. Filed Nov. 22, 1960.

An apparatus is designed for carrying out thermonuclear reactions by the bombardment of pellets by high-energy ion pulses. The apparatus comprises at least one ion accelerator, an ion deflector for deflecting the ion beam periodi-

cally, magnetic field means for pinching the ion pulses, a pellet-forming device, and means for causing the pellets to collide in free space with the ion pulses. (D.L.C.)

Shielding

28407 (EUR-142.d) ABSCHIRMSTUDIEN IM FORSCHUNGSZENTRUM ISPRA. (Shielding Investigations in Ispra Research Center). A. Kind and R. Nicks (European Atomic Energy Community. Nuclear Research Center, Ispra, Italy). 1962. 6p.

The necessity of thorough and detailed studies in the shielding field as well as the necessity of examining these studies in collaboration with other laboratories is analysed. (auth)

28408 (HW-SA-3032) RADIATION SHIELDING PROGRAM AT HANFORD. W. L. Bunch (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Apr. 27, 1963. Contract AT(45-1)-1350. 22p.

The shielding program is reviewed with respect to the gamma and neutron radiations associated with nuclear fission. The radiation sources and interactions are discussed. Descriptions are included of the experimental, calculational, and future programs in radiation shielding studies. (B.O.G.)

28409 (ORNL-RSIC-1) CUMULATIVE BIBLIOGRAPHY OF LITERATURE EXAMINED BY THE RADIATION SHIELDING INFORMATION CENTER (Oak Ridge National Lab., Tenn.). Apr. 1963. Contract [W-7405-eng-26]. 194p.

This bibliography represents the first cumulative edit of the literature examined by the Radiation Shielding Information Center recently established at the Oak Ridge National Laboratory. Its two major sections consist of a list of documents by subject category and an author index. The document list covers nine major subjects with a total of 118 categories; however, literature specimens were not entered for all categories. If a document applies to more than one category, it is listed under each. The author index includes cross references to the categories under which the author's publications appear. Preceding the bibliography is a list of the subject categories, their corresponding category numbers and the pages on which they appear in the bibliography. (N.W.R.)

28410 MINIMUM STRUCTURAL MASS FOR A MAGNETIC RADIATION SHIELD. S. W. Kash (Armour Research Foundation, Chicago). AIAA (Am. Inst. Aeron. Astronaut.) J., 1: 1439-41(June 1963).

It is shown that the mass of a magnetic shield is less than that of a bulk shield designed to protect an equivalent volume of the vehicle against energetic protons of ~1 Bev or more. A large reduction in the mass can be obtained by suitable design of the supporting structure. General limitations on the minimum structural mass associated with intense field producing coils are given. Specific formulas are developed for the structural mass required to support a circular cylindrical current sheet of arbitrary length and radius. This model is a good approximation for a solenoid coil for which the thickness of the windings is small in comparison with the radius. (C.E.S.)

28411 IMPORTANCE SAMPLING IN MONTE CARLO SHIELDING CALCULATIONS. I. NEUTRON PENETRATION THROUGH THICK HYDROGEN SLABS. M. H. Kalos (United Nuclear Corp., White Plains, N. Y.). Nucl. Sci. Eng., 16: 227-34(June 1963).

It is proposed that importance sampling may be carried out using an approximate analytic form for the importance function. An altered Boltzmann kernel may then be computed. Choosing from this altered kernel is facilitated, in part, by particle splitting. The method is carried out in detail for neutron penetration in hydrogen slabs. Results are given for dose buildup and energy spectrum for slab depths up to 179 mean free paths for 8.1 Mev neutrons. (auth)

Theoretical Physics

28412 THE VARIATIONAL METHOD APPLIED TO THE MONOENERGETIC BOLTZMANN EQUATION. PART I. G. C. Pomraning and M. Clark, Jr. (Massachusetts Inst. of Tech., Cambridge). Nucl. Sci. Eng., 16: 147-54 (June 1963).

The variational method as applied to the monoenergetic integro-differential Boltzmann equation is investigated. It is shown that rendering the Lagrangian stationary with respect to small changes in the directional flux and adjoint directional flux is equivalent to solving the Boltzmann and adjoint Boltzmann equations. Topics discussed include the use of variational weight functions, the inclusion of boundary terms in the functional, the interpretation of a variational optimum for a nonself-adjoint operator, and the second variation. It is shown that, for the general trial function ensemble and within a special restricted trial function ensemble, the variational method is a saddle point principle. The formalism developed is applied to the angular expansion in polynomials of the directional flux. (auth)

28413 THE VARIATIONAL METHOD APPLIED TO THE MONOENERGETIC BOLTZMANN EQUATION. PART II. G. C. Pomraning and M. Clark, Jr. (Massachusetts Inst. of Tech., Cambridge). Nucl. Sci. Eng., 16: 155-64 (June 1963).

The monoenergetic integro-differential Boltzmann equation with an arbitrary scattering kernel is transformed to a self-adjoint form and the corresponding Lagrangian written. It is shown that this transformation results in a loss of the continuity (neutron conservation) information contained by the Boltzmann equation. This information is recovered by writing the directional flux as the sum of an even and odd function (in angle) and considering a self-adjoint Lagrangian for only one portion (even or odd) of the directional flux. This procedure is shown to be equivalent to separating the nonself-adjointness from the Boltzmann operator. Further, it is shown that this self-adjoint principle is an extremum principle if the mean number of secondaries per collision is less than one. This self-adjoint formalism is applied to the angular expansion of the directional flux which results in an improved diffusion theory. Numerical results for the linear extrapolation distance and diffusion coefficient are compared with the classical (P – 1) diffusion theory. (auth)

28414 CAN THE DIRECTION OF FLOW OF TIME BE DETERMINED? Robert G. Sachs (Univ. of Wisconsin, Madison). Science, 140: 1284-90(June 21, 1963). (TID-18426)

A classical mechanical system is considered to demonstrate the nature of the problem. The difficulty of using a physical experiment to distinguish the different directions of time flow is illustrated. Experiments on the beta decay of neutrons, nonleptonic decay of the Λ hyperon, and K^0-decay that might reveal time variance and CPT-variance are discussed. In CPT-invariance, violation of which would permit determination of time flow, C stands for the

interchange of matter and antimatter; P, for the interchange of left and right (handedness); and T, for the interchange of past and future. (D.C.W.)

28415 LECTURES ON NUCLEAR THEORY. Revised Edition. L. D. Landau and Ya. Smorodinskii (Smorodinsky). New York, Plenum Press, Inc., 1959. 112p. $5.25.

A series of ten lectures on nuclear theory is presented. The conclusions concerning nuclear structure are limited to those that can be reached from an analysis of the available experimental data using only general quantum-mechanical relations. The topics covered include nuclear forces, nucleon-nucleon scattering at high and low energies, independent particle model for nuclear structure, structure of light and heavy nuclei, statistical theory of nuclear reactions, optical model for nuclear reactions, deuteron reactions, and a description of the properties of mesons(π) and their interactions with nucleons. (C.E.S.)

REACTOR TECHNOLOGY

General and Miscellaneous

Refer also to abstracts 27742, 27797, 27890, and 28245.

28416 (AE-108) TWO-GROUP ANALYSIS OF XENON STABILITY IN SLAB GEOMETRY BY MODAL EXPANSION. Olov Norinder (Aktiebolaget Atomenergi, Stockholm). May 1963. 50p.

Xenon spatial stability is analyzed with the flux represented by two neutron energy groups. General formulas are given for expansions in a system of modes. Detailed formulas are recorded for a slab described by sinusoidal modes. A short description is given of a Mercury Autocode program for numerical calculations in slab geometry. The essential input parameters and results are noted for 80 computed cases. The main body of the calculations was intended to clarify the xenon stability properties of the Marviken reactor, which was found to have a sufficient margin against unstable xenon oscillations. The neutron flux detection and the control rod insertion in the slab were found to have a large influence on the stability in spite of the nonexistence of space-selective control in the systems investigated. Very good agreement was found between stability limits calculated according to Randall and St. John and stability limits calculated by the program. (auth)

28417 (AEEW-M-318) PIXSE. J. D. Macdougall (United Kingdom Atomic Energy Authority. Reactor Group. Atomic Energy Establishment, Winfrith, Dorset, England). Apr. 1963. 15p.

The computer program PIXSE that computes, from the scattering law, generalized energy transfer cross section matrices and source terms for thermal reactor calculations is described. It is available in Fortran II for the 7090 and in S1 for Stretch. Output in a format suitable for use with the Carlson program WDSN may be produced. (auth)

28418 (AEEW-R-172) EXPERIMENTAL RELEASE OF RADIO-IODINE IN THE ZENITH REACTOR CONTAINMENT. J. F. Croft and R. S. Iles (United Kingdom Atomic Energy Authority. Reactor Group. Atomic Energy Establishment, Winfrith, Dorset, England). Sept. 1962. 41p.

Experiments are described in which a mass of iodine, corresponding approximately to the maximum iodine equilibrium core inventory of the Zenith reactor, was released as molecular vapor into the secondary containment. The releases were of stable I^{127}, labeled with radioactive I^{132}, and yielded initial iodine airborne mass concentrations of 0.3 to 0.8 $\mu g/m^3$. The experimental conditions included those with and without forced ventilation of the containment. The subsequent deposition and leakage behavior of the iodine was examined. In the unventilated condition the form of iodine remaining airborne changed with time. The molecular vapor plated out relatively quickly, with an effective deposition velocity $\sim 4 \times 10^{-2}$ cm/sec, leaving a mixture of particulate-carried and a nonmolecular vapor form of iodine, with the former predominant. Both these residual forms exhibited a similar effective deposition velocity of $\sim 5 \times 10^{-3}$ cm/sec. The results obtained were used to evaluate the maximum conceivable I^{131} release from Zenith, and this is shown to be a small fraction of the core inventory. The results, and those of other workers using molecular vapor sources, are assessed for general applicability in reactor safety studies, bearing in mind that other potential forms of iodine release from irradiated fuel must be considered. (auth)

28419 (BAW-1268) THERMAL ACTIVATION METHOD FOR ρ_{28} MEASUREMENTS IN SLIGHTLY ENRICHED URANIUM OXIDE LATTICES. R. H. Lewis, T. C. Engelder, D. M. Roberts (Babcock and Wilcox Co. Critical Experiment Lab., Lynchburg, Va.); and D. B. Wehmeyer (Babcock and Wilcox Co. Atomic Energy Div., Lynchburg, Va.). May 1963. Contract AT(30-1)-2602. 52p.

The thermal activation method for measuring ρ_{28} in heterogeneous slightly enriched UO_2 lattices is described, and results for 12 water-moderated lattices are given. The technique has three primary advantages over conventional U^{238} cadmium-ratio measurements: uranium activities are measured by chemically processing the irradiated fuel to avoid problems associated with the use of U^{238} foils; cadmium-covered uranium measurements are eliminated to avoid cadmium perturbations; and ρ_{28} is obtained directly, rather than by subtracting one from the cadmium ratio, to avoid large errors when the cadmium ratio approaches unity. The technique compares total absorptions in U^{238} to thermal absorptions in an intermediate material, usually dysprosium, having a much higher probability of thermal absorptions. Then the thermal absorptions in dysprosium and uranium are normalized in a thermal irradiation. The technique is shown to be capable of measuring ρ_{28} with an accuracy of 1%, independent of the value of ρ_{28} and relatively free from systematic errors. (auth)

28420 (CNAEM-8) ON SECOND ORDER CORRECTION TO THE AVERAGE EXTRAPOLATION LENGTH. E. Inoenue (Turkey. Atomic Energy Commission. Cekmece Nuclear Research Center, Istanbul). 1963. 11p.

A first-order expression for the average extrapolation length in bare thermal reactors was given previously on the basis of a many-group calculation. C. Yalcin extended this calculation to second order and obtained a complicated correction term that seems difficult to apply. His results are analyzed and simplified here by considering the limit for continuous slowing down. It is shown that the second order correction is of the order of $\bar{d}/R$, where $\bar{d}$ is the first order average extrapolation length and R is a length that characterizes the size of the reactor. (auth)

28421 (ÇNAM-5) UNE REMARQUE SUR LE FACTEUR DE CONVERSION DES MILIEUX MULTIPLICATEURS NUS CRITIQUES. (A Remark on the Conversion Factor of Bare, Critical Multiplying Media). Ahmed Yueksel Oezemre (Turkey. Atomic Energy Commission. Çekmece Nuclear Research Center, Istanbul). 1963. 7p.

It is shown that for a multiplying medium that is bare, homogeneous, and critical, the conversion factor is independent of the geometry, and that it is equal to the difference between the conversion factor and reactivity excess of the corresponding infinite medium. (T.F.H.)

28422 (DPST-63-69-3) EFFECT OF ROD SPACING ON HEAT TRANSFER BURNOUT. USAEC-AECL COOPERATIVE PROGRAM. Quarterly Progress Report, December 1962–February 1963. R. H. Towell (DuPont de Nemours (E. I.) & Co. Savannah River Lab., Aiken, S. C.). Apr. 1963. Contract AT(07-2)-1. 12p.

Economic studies have indicated that heavy-water-moderated power reactors cooled by boiling light water have considerable economic promise. A practicable reactor would contain a minimum amount of light-water poison in the fuel coolant channels. This is achieved by operating with closely spaced fuel rods and high outlet steam qualities. Measurements of the heat transfer coefficient, burnout heat flux, and pressure drop will be made on a 4-ft-long mockup of the central rod and 6 intermediate rods of a 19-rod bundle. Steam quality will be varied up to about 60% and mass flow up to about 2.5×10^6 lb/(hr)(ft^2). The effects of spacers and both vertical and horizontal orientation of the test section will be determined. Design of the test section components is described. All components are ordered and some are being fabricated. (auth)

28423 (DPST-63-69-6) EFFECT OF ROD SPACING ON HEAT TRANSFER BURNOUT. USAEC-AECL COOPERATIVE PROGRAM. Quarterly Progress Report, March–May 1963. R. H. Towell (Du Pont de Nemours (E. I.) & Co. Savannah River Lab., Aiken, S. C.). [June 1963]. Contract AT(07-2)-1. 21p.

Measurements of the heat transfer coefficient, burnout heat flux, and pressure drop will be made on a 4-ft-long mockup of the central rod and 6 intermediate rods of a 19-rod bundle. Steam quality will be varied up to about 60% and mass flow up to about 5.0×10^6 lb/hr(ft^2). The effects of spacers and both vertical and horizontal orientation of the test section will be determined. All components were fabricated except the surrounding-rod mockup. The operating characteristics of the test section were calculated. (N.W.R.)

28424 (EUR-83.f) CYCLES DE VAPEUR POUR UNE CENTRALE DE PUISSANCE ORGEL. (Steam Cycles for an ORGEL Power Plant). S. Orlowski (European Atomic Energy Community). 1962. 55p.

When account is taken of the thermal, technological and neutronic factors involved, the range of organic coolant temperatures for ORGEL appears to be transitional. In the light of the technical and economic comparison drawn between the cycles with one steam pressure and re-superheating, those with one steam pressure and a mechanical separator, those with two steam pressures, and those with one steam pressure and no re-superheating which were studied for reference purposes, the first-mentioned cycles appear to hold out the greatest promise for ORGEL. As compared with the reference cycle, these cycles would make it possible to effect a saving of 0.1–0.2 mill on the price per kwh supplied by the nuclear power plant, and would present hardly any costly technological development problems. (auth)

28425 (EUR-102.f) POIDS STATISTIQUE POUR LE CALCUL DE L'EFFET SUR LA RÉACTIVITÉ DU XÉNON A L'ÉQUILIBRE. (Statistical Weight Factor for Calculating Xenon Effect on Reactivity in Equilibrium Conditions). G. Casini and J. Pillon (European Atomic Energy Community. Nuclear Research Center, Ispra, Italy). 1962. 19p.

A quick method to calculate the xenon poisoning in the reactor design is shown. By defining a statistical weight factor G, it is possible to evaluate the reactor poisoning by the calculation of the poisoning in one point. Plots of the G factor as a function of the geometrical and flux parameters are given for a cylindrical reactor with a flattened central region. (auth)

28426 (EUR-129.f) VARIATION DE LA RÉACTIVITÉ A LONG TERME POUR DIFFÉRENTS TYPES DE CIRCULATION DU COMBUSTIBLE. (Variation of the Long Term Reactivity for Different Types of Fuel Cycles). G. Blaesser, G. Casini, and J. Pillon (European Atomic Energy Community. Nuclear Research Center, Ispra, Italy). 1962. 34p.

The variation of the long-term reactivity for different types of fuel cycles is studied. For each fuel cycle the spatial distribution of the irradiation (integral flux) τ under steady-state conditions is determined. τ values induces a spatial distribution of the concentrations and lattice parameters, especially of B^2. The effective value B^2_{eff} and thus k_{eff} of the reactor is obtained from these local values of B^2 by integration with the usual statistical weight factors. (auth)

28427 (EUR-130.f) ECO—EXPÉRIENCE CRITIQUE POUR L'ÉTUDE DE LA FILIÈRE ORGEL. (ECO—Critical Experiment for the Study of the Orgel Lattice). G. Blaesser, P. Bonnaure, G. Casini, R. Cenerini, V. Raievski, and F. Toselli (European Atomic Energy Community. Nuclear Research Center, Ispra, Italy). 1962. 43p.

Difficulties in the estimation of the reactivity balance for ORGEL-type reactors (natural or slightly enriched, heavy water moderated, organic-cooled reactors) where the fuel in each channel is subdivided and the coolant temperature differs from that of the moderator are analyzed. The incertitude resulting from this makes hazardous the evaluation of the economy of such a reactor type. Development can only be achieved if these incertitudes are covered by preliminary experiments (exponential or critical) for the interesting lattices. The ECO reactor is an instrument for such experiments. A description is given of the general idea, the details of the design, and the equipment of this reactor which is now in construction, as well as a short summary of the initial experimental program. (auth)

28428 (EUR-149.f) MANUEL DU BLINDAGE DE L'EXPÉRIENCE CRITIQUE ORGEL (ECO). (Manual on Shielding of the ORGEL Critical Experiment (ECO)). U. Canali, R. Nicks, and C. Pleinevaux (European Atomic Energy Community. Nuclear Research Center, Ispra, Italy). 1963. 99p.

The thickness of the lateral, bottom, and top shields of ECO for the nominal power of 1 kw is given. For reduced power, three bottom shields are proposed. The penetrations in the various shields are verified, as well as the activity of the cooling air. (auth)

28429 (GEAP-3771-5) HIGH PERFORMANCE UO_2 PROGRAM. Quarterly Progress Report No. 5, April–June 1962. B. Weidenbaum (General Electric Co. Atomic Power Equipment Dept., San Jose, Calif.). June 1962. Work performed under United States–Euratom Joint Research and Development Program. Contract AT(04-3)-189. 78p. (EURAEC-489).

Three fuel rods containing UO_2 pellets, all equipped with pressure sensing transducers, are being irradiated in the VBWR. The pellets for each rod have a density of 98% and an enrichment of 3.9%; 98% and 7.0%; and 93% and 3.8%, respectively. The pressure build-up in the pellet rods with low enrichment UO_2 still remains fairly constant at a low value. The pressure build-up in the pellet rod with high enrichment UO_2 is now 180 psig at an estimated burnup of 2200 MWD/T with reactor power at 26 MW. Pre-irradiation shakedown of the pressurized water loop was completed with non-fueled assemblies. The loop water chemistry specifications were modified to reduce the likelihood of crud deposition on the fuel rods; alterations necessary

to effect these new coolant specifications were completed. Installation of the underground tank system for high level liquid waste was completed and the system is operational. The PWL operated with fueled assemblies during GETR Cycles 33 and 34 without incident. The peak surface heat flux during the irradiation of pellet fuel assembly EPT-6 for one cycle in the PWL was 645,000 Btu/hr-ft^2. Some axial warpage and swelling in the peak heat flux region hampered the removal of the fuel rods from the shroud tubes in the assembly. The peak surface heat flux during the irradiation of pellet fuel assembly EPT-8 for one cycle in the PWL was 900,000 Btu/hr-ft^2. The irradiation of pellet fuel assembly EPT-10 was begun with a peak surface heat flux of 1,050,000 Btu/hr-ft^2 at start-up. Positive evidence of UO_2 melting was found in Trail Cable Capsule No. 6. Analysis of the results from the three Trail Cable capsules is continuing in an effort to derive the pellet-cladding interface conductivity, the variation of the interface conductivity with surface heat flux, the thermal conductivity of UO_2 at 3,000 to 5,000°F, and the surface heat flux required to induce UO_2 melting in the capsule. (auth)

28430 (GEAP-3933) DESIGN REPORT. SUPERHEAT STRAIN-CYCLE CAPSULE. I. L. Marburger, E. A. Haglund, D. E. Hafer, D. J. Liffengren, and S. F. Armour—R. G. Kuhne, comp. and ed. (General Electric Co. Atomic Power Equipment Dept., San Jose, Calif.). Jan. 1963. Contract AT(04-3)-189. 48p.

Design of core components for thermal spectrum superheat reactors should be such as to reduce the parasitic neutron absorption capture to a minimum. Fuel element clad thickness must, therefore, be kept as low as possible without jeopardizing fuel life performance required in power producing reactors. Because of stress factors during reactor operation the fuel sheath surrounding the fissionable material is subjected to low cycle fatigue at various strain levels depending upon reactor operating levels. In order to investigate the low frequency strain cycle fatigue for tubular sheath geometries on apparatus was designed and fabricated for laboratory and reactor experiments. The design of this apparatus is described. (auth)

28431 (GEAP-4216) PROGRAM FOR THE DEVELOPMENT OF PLUTONIUM RECYCLE FOR USE IN LIGHT WATER MODERATED REACTORS. Quarterly Progress Report, January 1–March 31, 1963. M. A. Robkin (General Electric Co. Vallecitos Atomic Lab., Pleasanton, Calif.). Apr. 8, 1963. Work performed under United States–Euratom Joint Research and Development Program. Contract AT(04-3)-189. 4p. (EURAEC-633)

The program fuel element was exposed to a burnup of 465 Mwd/t, which brings the total to 2334 Mwd/t, in the VBWR. Chemical and mass-spectrographic assays were completed on six radial samples and the pellet average sample extracted from a rod at an estimated burnup of 2000 Mwd/t. Cerium and cesium analyses indicated burnup of about 1860 Mwd/t. Autoradiographic and metallographic examination of the polished surface of the rod showed that the micro-segregation of the PuO_2 observed in the fabricated fuel was still present. Thermal average cross sections for all of the isotopes contained in the project fuel were computed by the THERMOS code. The epithermal cross sections and the fast-to-slow flux ratio were obtained from a MUFT-type calculation. (M.C.G.)

28432 (HW-SA-3045) NUCLEAR REACTOR FUEL QUALITY. W. R. Krehbiel (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). May 24, 1963. Contract AT(45-1)-1350. 18p.

Types of audits used in quality control analyses are described in terms of product quality audit, procedures audit, and quality system appraisal. The application of quality control methods to the manufacture of NPR fuel elements is discussed. (B.O.G.)

28433 (IDO-11005) ORGANIC COOLANT ESSENTIAL DATA. Quarterly Report No. 7, January to March 31, 1963. J. A. Ellard, C. D. King, W. J. Moodie, and W. H. Yanko (Monsanto Research Corp. Dayton Labs., Ohio). Apr. 18, 1963. Contract AT(10-1)-1088. 8p.

Biphenyl heat capacity measurements were completed, and the results analyzed with respect to the values derived from PVT data. The inconsistencies between the two sets of data were chiefly due to biphenyl vapor density values at low temperatures. Additional vapor density data were obtained, and a new biphenyl thermodynamic network calculation is in progress. Far infrared absorption measurements were made on biphenyl to verify the presence of the calculated but previously unobserved 120 and 140 cm^{-1} bands which were included in the zero pressure heat capacity values used in previous thermodynamic calculations. The only band observed was at 117 cm^{-1} which would not appreciably change the previously used zero pressure heat capacity values. Liquid heat capacity from 60 to 400°C and PVT measurements were made on ortho-terphenyl. Heat content of meta-terphenyl from 90 to 250°C was measured. Heat transfer runs (95) were made with biphenyl during this quarter over 500 to 815°F under four different circulation conditions. Analysis of the data is underway and will be reported in a topical report. No further experiment heat transfer work is planned. (auth)

28434 (IDO-16858) EVALUATION OF CATALYSTS FOR SELECTIVE HYDROCRACKING OF POLYPHENYLS. L. E. Gardner (Phillips Petroleum Co. Research and Development Dept., Bartlesville, Okla). Apr. 25, 1963. Contract AT(10-1)-1080. 31p.

Metal-promoted aluminas of low surface area and free from acidity were found to be the best catalysts for selectively hydrocracking the carbon-carbon bond between phenyl rings in polyphenyls in an extensive screening program carried out on biphenyl, o-, and m-terphenyls as model charge stocks. With cobalt molybdate or nickel oxide (1.3%) on gamma alumina of 25 to 100 sq m/gram surface area, conversions of 60 to 95% were obtained with 60 to 80% selectivity for the desired chain-splitting reaction. Vanadia-cobalt oxide or platinum on this alumina base were also found to be active and selective for this reaction. Hydrocracking was carried out at temperatures from 800 to 1000°F and pressures from 500 to 1000 psig. The feed was ordinarily a 10 to 50 wt % solution in xylene and was pumped over the catalyst at from 0.5 to 2.0 liquid volumes per hour with 10 to 50 moles of hydrogen per mole of polyphenyl circulated with it. With these simple model compounds it was possible, primarily by gas-solid chromatographic columns, to characterize completely the cracked products obtained. Alkyl biphenyls or alkyl benzenes, from terphenyl or biphenyl feedstock respectively, were the principal by-products found, resulting from the competing reactions of hydrogenation, ring cleavage, and polymerization. Coke formation was low, normally about 0.5% of the feed in a two-hour run. Dual function catalysts, which actually promote both ring hydrogenation and cracking were found to be unsatisfactory. High yields of undesired low molecular weight products and alkyl polyphenyls resulted. Catalysts on silica or silica-alumina, or acid treated samples all displayed too much cracking activity and coke formation. Total conversion appeared to be independent of

catalyst surface area, but selectivity was greatly improved and coke yield reduced as surface area was decreased down to 25 sq. m/gram. Using the selective catalysts, reclamation of high boiling polyphenyl polymers resulting from radiolysis of terphenyls in the core of a nuclear reactor will be studied. Successful conversion of a major portion of this waste to usable coolant can be an important factor in reducing the costs of the use of terphenyl as a coolant-moderator in a power reactor. (auth)

28435 (IDO-16877) CATALYTIC HYDROCRACKING OF HIGH BOILER IN NUCLEAR REACTOR COOLANT. L. E. Gardner (Phillips Petroleum Co. Research and Development Dept., Bartlesville, Okla.). May 20, 1963. Contract AT(10-1)-1080. 34p.

Selective hydrocracking of total coolant was found to be an efficient and economic method for reconstitution of high boiler in the coolant to usable product. Such a process could eliminate the expense of vacuum distillation and disposal of high boilers produced in a nuclear reactor power plant. The selective conversion was possible since polyphenyls were found to be more susceptible towards hydrocracking as the phenyl chain length increased. Both cobalt molybdate on alumina and nickel oxide on alumina (50 to 80 square meters per gram) were found to be efficient catalysts at conditions of 900°F and 1000 psig with the latter giving more selective conversion to terphenyls. Continuous flow hydrocracking tests on OMRE Core II coolant (containing 23% high boiler) resulted in 90 to 100% conversion of high boiler at product recoveries of 85 to 95 wt %. Average molecular weights of the products (biphenyl and heavier) were in the range 205 to 225 compared to 270 for Core II coolant. High boiler in Core III-A coolant which contained mainly first-generation polymers (hexaphenyls) was slightly more refractory toward hydrocracking than Core II high boiler, and conversion decreased slightly with increasing on-stream time. However, at optimum conditions for processing coolant, coke formation on the catalyst for Core III-A coolant was about one-third that for Core II coolant. Products from hydrocracked OMRE coolant samples were found to be stable to electron irradiation at 650°F and dosages on the order of 10^9 to 10^{10} rads, and pyrolysis threshold temperatures were between 750 and 825°F in 48-hour tests. A proposal was outlined for utilization of the process in the Coolant Technology Loop at the EOCR at the National Reactor Testing Station. A conservative cost estimate was made for a 1000-megawatt-per-day (thermal) reactor producing 25,000 pounds per day of high boiler (minimum value). Total manufacturing cost was 7 cents per pound compared to the present cost of fresh terphenyl coolant (Santowax OMP) of 17 cents per pound. On the assumption that the cost of fresh coolant would ultimately be reduced to 10 cents per pound, a payout for the estimate was 3.7 years. (auth)

28436 (IDO-16890) SPERT PROJECT. Quarterly Technical Report, October–December 1962. F. Schroeder, ed. (Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho). May 17, 1963. Contract AT(10-1)-205. 50p.

A successful integral-core destructive test was performed in the Spert I facility with a highly enriched, plate-type, water-moderated core. A 3.2-msec-period power excursion was initiated by an essentially stepwise addition of 3.5 dollars of reactivity. The excursion was self-limiting, with a peak power of 2.3 Gw and with a nuclear energy release in the burst of 31 Mw-sec. After the nuclear excursion had self-limited and the power had returned to a level of about 5% of the peak value, a sudden pressure rise occurred which disassembled the core and produced widespread damage to associated equipment. The maximum fuel alloy temperature was slightly in excess of 1200°C, in agreement with calculations based on the measured nuclear energy release. The characteristics of the nuclear burst for the destructive test were in agreement with predictions based on extrapolation of the results of previous non-destructive tests. The peak pressure in the explosion, which occurred after the nuclear burst, was of the order of several thousand psi and the rise time of this pressure pulse was significantly less than 1 msec. A series of static experiments was performed in the Spert II facility for a close-packed core with D_2O as the moderator in order to obtain information to aid in the design of necessary structural components for kinetic testing of this type of core under various initial system conditions, including forced coolant flow. Critical experiments were performed and a 57-assembly core was determined to have a cold, clean excess reactivity of 9.6 dollars and a shutdown reactivity margin of about 6.6 dollars. A 52-assembly core having a shutdown margin of about 10 dollars was used for a series of reactivity worth measurements of fuel assemblies in various positions on the core perimeter and of typical structural components in the reflector region around the core. An experimental program was undertaken in the Spert IV reactor to determine if any significant changes in neutron flux distribution, ion chamber power calibration, or reduced prompt neutron lifetime could be measured as a result of a large population of voids in the central region of the core, such as might arise during an excursion test. The thermal neutron flux in the center of the core is depressed by the presence of voids, and the flux spectrum is slightly hardened. However, the power calibration of typical neutron-sensitive ion chambers in the reflector and the value of the reduced prompt neutron lifetime (measured by analysis of statistical fluctuations of the core neutron population) are relatively insensitive to the presence of a centrally located void population worth approximately two dollars in reactivity. The isothermal temperature coefficient for the Spert IV core was measured over the temperature range of approximately 20 to 35°C and found to vary from −0.7 to −1.2¢/°C. An analysis was performed of the dynamics of reflector-perturbed reactors. This analysis has shown that the dynamic behavior of a reflected reactor perturbed by changes within the reflector differs both from the behavior of the statically-equivalent bare reactor and from the behavior of the same reflected reactor perturbed within the core, because the perturbation alters the values of the reflector delayed-group parameters. While for the case of a reflected reactor perturbed in the core it is possible to out-run the reflected neutrons, for the reflector-perturbed case this is not possible. Thus, the parameters which define the inhour relation or the transfer function representing the response of the reactor to reactivity feedback mechanisms acting within the core cannot be completely determined by experiments in which reflector perturbations are used to vary the reactivity of the system. An illustrative example is presented for an enriched-uranium, plate-type D_2O-moderated and -reflected reactor. (auth)

28437 (KAPL-2000-20) REACTOR TECHNOLOGY REPORT NO. 23—PHYSICS. (Knolls Atomic Power Lab., Schenectady, N. Y.). May 1963. Contract W-31-109-eng-52. 123p.

A geometrically simple homogeneous assembly (SHA, described herein) was designed and built to provide data

such as criticality and flux distributions for comparison with such quantities obtained theoretically from few-group or multigroup treatments. Since the calculated information depends very little on geometric or other mathematical complexities, these comparisons will be highly useful in the evaluation of group constants produced from basic nuclear data. For example, the diffusion length for thermal energy neutrons can be measured or calculated from theoretical models for the scattering of thermal neutrons. Good agreement between the two methods is reported here for the cases of room-temperature water and polyethylene; indeed, the agreement is good for water over a wide range of temperatures, but fails for hot polyethylene. The reactivity coefficient of aluminum has consistently been calculated to be larger than measured. Theoretically derived modifications for the MUFT tape aluminum data still fail to produce an acceptable coefficient, but improvements in the model for reactor calculations have reduced the disagreement from 80 to 45%. The preparation of multigroup data (such as that for MUFT, above) has typically been a very laborious affair, involving many weighted averages of microscopic nuclear data. To make this a faster and more efficient process, the computer program CADAVER has been developed to perform required averaging for both elastic and inelastic scattering and smooth capture of neutrons. Further work to increase the accuracy of MUFT was performed to provide resonance self-shielding factors for aluminum and zirconium. The factors that are supplied account for decreased resonance absorption resulting from resonance scattering. The use of flux and power distributions in reactor cores results from a diffusion theory approach to neutron transport; an alternative to this is described. Employing such directly meaningful and interrelated quantities as reflection and transmission probabilities and unidirectional neutron currents in slab geometry, mathematical relations can be established for criticality and for disadvantage factors. Pile oscillator techniques have been recognized as being more sensitive than static methods for determining resonance integrals. An especially sensitive oscillator system was installed in the Thermal Test Reactor (TTR); preliminary measurements with hafnium samples indicate that an accuracy of 0.002 ¢ is available from data accumulation over a one minute period at 100 w power. This permits measurements on very minute samples or on very weakly absorbing materials. On the theoretical side, development was begun on a program, MOST, which serves to compare experimental cross-section data (microscopic) with the results of quantum mechanical calculations and to provide values of theoretical nuclear parameters which yield best fits to the measured data. A description is given of a technique whereby MOST can also be applied to the solution of rather general and complicated equations. Current best values for fast-neutron scattering cross-sections in aluminum and zirconium, and resonance parameters in zirconium, were established through theoretical calculations and review of recent data. The new information thus developed was incorporated in MUFT data tapes. Estimates on the extent to which calculated criticality values are affected by changes in nuclear data were obtained. Reactivity changes were tabulated for sets of calculations for water-moderated systems containing either zirconium or aluminum; these changes were produced by altering elastic or inelastic scattering in the metal. Ten percent changes in large portions of the data were observed to introduce roughly a 0.5% change in k. The sixth edition of the chart of the Nuclides was issued. The detailed behavior of neutron distributions, in energy and/or spatial dependence, was examined with a number of techniques. Special distributions of thermal neutrons in hydrogen-moderated fuel-bearing assemblies were measured and calculated for a variety of mixtures and temperature conditions. Very carefully performed chopper measurements were calculated satisfactorily with a bound hydrogen kernel for systems with low absorption rates. For systems more highly loaded with fuel, a free hydrogen kernel produces best agreement with experiment; this unsatisfactory situation is not understood. Space-dependent spectra at epithermal energies can be calculated with such programs as P1MG or TET, but only at rather high cost in computer time. Work was done to learn whether the application of variational techniques to P1-type equations could reduce computer time without loss in accuracy. The MUSKRAT program, developed in these studies, has not been proven to be a satisfactory successor, although it is nearly as good as P1MG. Several lattices were examined in detail with both P1MG and TET, to determine whether the low-order angular approximation in the former produced significant errors in the epithermal spectra (and group constants). Although infinite-medium spectral calculations would be inaccurate for the lattices considered, the results with a simple P1 anisotropy proved to be sufficiently close to the double P5 available from TET results. Several formulations were developed for the calculation of approximate blackness coefficients. Ranging from a diffusion theory approach to use of integral theory variational expressions for slab transmission, reflection and absorption, the methods were relatively poor or good; the latter yielded results that differed by 2% or less from exact values for a slab of any selected optical thickness and scattering properties. Calculations and experiments are reported for the scattering cross section, and for the energy distribution of thermal neutrons in cold (–198°C) polyethylene. Agreement between the measured and calculated spectral data at this low temperature adds confidence in the theoretical model employed for the scattering. The analysis of slowing down experiments conducted with low-energy neutrons has long been viewed as a possible way of verifying theoretical scattering kernels. Only recently, however, have sufficiently accurate experiments been performed to bolster this view. Although the results available are not yet conclusive, those presented here show improved agreement between theory and experiment. A very accurate yet simple method of determining the absorption coefficient and reflected angular distribution for a semi-infinite plane slab with an arbitrary ratio of scattering to absorption is described. Results obtained with this method show a nonlinear variation of the emergent flux with the cosine of the angle of emergence. When this is a strong effect, even a double P1 approximation may lead to an unsatisfactory flux description. A variational method for nonlinear reactor kinetic problems is reported. (auth)

28438 (KAPL-M-BEE-1) FUEL ELEMENT TEMPERATURE LAG DURING REACTOR POWER TRANSIENTS. B. E. Eno (Knolls Atomic Power Lab., Schenectady, N. Y.). Mar. 15, 1963. Contract W-31-109-eng-52. 30p.

The analytical derivation of an equation describing the temperature as a function of space and time for any power transient for a cladded plate-shaped fuel element is presented. The resulting equation is used to demonstrate the degree of temperature lag, defined as the difference between temperature calculated by steady-state methods and the true temperature, encountered during reactor transients. Comparison is made between the transient temperature distribution equation presented and existing transient temperature distribution computer codes to determine advantages in use of each. Other possible uses of the analysis

are briefly discussed in respect to nuclear power reactors. One such use is adaptation to in-pile transient test thermocouple temperature lags. (auth)

28439 (KAPL-M-JNB-1) SOME EXPERIMENTAL TECHNIQUES AND DATA REDUCTION METHODS FOR THE DETERMINATION OF POWER DISTRIBUTIONS IN CRITICAL ASSEMBLIES. J. N. Brazos (Knolls Atomic Power Lab., Schenectady, N. Y.). Dec. 26, 1962. Contract W-31-109-eng-52. 69p.

A description of the experimental technique and data reduction methods used to obtain detailed power distributions in a critical facility from activating and counting its fuel is given. The procedure represents a method for obtaining relative power densities at various points throughout the assembly and also includes a technique for the determination of absolute power. The methods used are described in terms of plate assemblies but could be applied to more general configurations. A number of correlation methods are described which allow one to make a more proper comparison of the critical assembly results with those which are calculated by analysis or those to be obtained with the actual power reactor being mocked by the critical assembly. In particular, a method for handling power tilting corrections is presented. (auth)

28440 (KAPL-M-RPC-8) FLOCK, A PROGRAM TO OBTAIN FITTED SELF-SHIELDING COEFFICIENTS FOR KARE R-Z SYNTHESIS INPUT. Donald E. Goodman (Knolls Atomic Power Lab., Schenectady, N. Y.). Mar. 1963. Contract W-31-109-eng-52. 30p.

FLOCK obtains self-shielding and rod absorption factors from previously run KARE, FLEER, or x-y problems, which are representative of elevation, temperature, and rod conditions. Major, minor, and sub-channels are specified. These factors are fitted as a function of the fuel (or poison) fraction remaining by the least squares polynomial approximation method. Coefficients are obtained for unrodded and rodded self-shielding factors for structures, fission products, xenon, K, γ, and rod absorption. Data needed in the calculation is taken from one or more specified problems existing on one or more KARE history tapes. Coefficients for steady state, peak, and maneuvering xenon are set equal to unity. Output is Hollerith punched cards in a form usable as direct input to KARE r-z synthesis problems. (auth)

28441 (MITNE-29) IRRADIATION LOOP STUDIES OF ORGANIC REACTOR COOLANTS. Progress Report, January 1–September 30, 1962. E. A. Mason and C. D. Sawyer (Massachusetts Inst. of Tech., Cambridge). Feb. 15, 1963. Contract AT(10-1)-1067. 25p. (IDO-11106)

During the report period, a constant HB level of about 33 wt. % was maintained in the loop in order to study the long-term effects on the physical and chemical properties of Santowax OMP under in-pile irradiation at 600°F. Part of the data analysis is still underway so that the results should be treated as preliminary in nature. The density, viscosity, and number average molecular weight of the coolant during the steady-state-HB period were found to be approximately constant, implying that a steady level in these variables can be maintained during a long-term irradiation. The heat transfer data agree very well with results reported in the literature. A maximum limit on the scale resistance built up over one year of operation appears to be less than 10% of any of the measured heat transfer resistances from the heater wall to the bulk coolant. Data taken from the steady-state-HB period indicate a HB production rate of 0.7 g HB/Mwh of reactor operation or a value of $G(\rightarrow HB) = 0.15$ at 33% HB. (auth)

28442 (NAA-SR-Memo-6688) IDENTIFICATION OF REAL AND SPURIOUS SCRAMS INITIATED BY THE SRE LOG N–PERIOD CIRCUIT. E. L. Gardner and R. A. Lewis (Atomics International. Div. of North American Aviation, Inc., Canoga Park, Calif.). Apr. 1, 1963. Contract AT-11-1-GEN-8. 18p.

Theoretical and experimental analysis of the time response of SRE period range instrumentation shows that real reactor scrams can be identified by prescram upscale spikes on the Log N, period, electrometer, and flux controller recorders. Spurious scrams will not cause this type of response. These identification criteria are valid only if periodic maintenance of the recorder pens is performed to ensure their operation during fast transients. (auth)

28443 (NAA-SR-Memo-8406) HYDRAULIC STUDIES OF A PROPOSED 9-ROD SRE 3RD CORE FUEL ELEMENT. J. H. Brindley (Atomics International. Div. of North American Aviation, Inc., Canoga Park, Calif.). Apr. 23, 1963. Contract AT-11-1-GEN-8. 21p.

Hydraulic tests were performed in a hydraulic loop on a mockup of a 9-rod fuel element which is proposed for the SRE 3rd Core. The fuel element consists of an annular ring of nine fuel rods surrounding a central support tube bounded by a process tube. The exit section of the fuel element contains an orifice plate to provide gross flow control and a variable orifice to provide vernier flow control. Pressure drop-flow rate data for the fuel element assembly and calibration of the variable orifice were obtained over a Reynolds number range of 12,000–150,000. Principles of dimensional similitude were used to convert the water test data to the SRE coolant conditions. (auth)

28444 (NP-12910) HIGHLY NEGATIVE REACTIVITY MEASUREMENT USING PSEUDO-RANDOM SOURCE EXCITATION AND CROSS-CORRELATION. Thomas E. Stern and Jean Valat (France. Commissariat à l'Énergie Atomique. Centre d'Études Nucléaires, Saclay). [1962]. 33p.

An experimental investigation of reactivity measurement in the far subcritical range is presented. Reactivity is measured by a digital cross correlation technique, wherein the input to the system is a neutron source, electronically modulated by a pseudo-random square wave, and the output is the neutron counting rate. The experiments show that the method is feasible, although further equipment refinement is necessary to improve precision. (auth)

28445 (NP-12925) TESTS ON MODELS OF NUCLEAR REACTOR ELEMENTS. I. HEAD LOSSES IN BLANKET SUB-ASSEMBLY. J. S. McNown, R. A. Yagle, and W. W. O'Dell (Michigan. Univ., Ann Arbor. Engineering Research Inst.). Mar. 1956. For Atomic Power Development Associates, Inc., Detroit. 20p. (UMRI-2431-1-P)

For a model blanket sub-assembly of the proposed APDA reactor, laboratory measurements were made of the head losses for the blanket element and for the various distributing orifices. Tests with water were generalized to provide design criteria for liquid sodium. (auth)

28446 (ORNL-TM-590) AN ECONOMIC ANALYSIS OF THE DOMESTIC AND OVERSEAS SHIPMENT OF SPENT REACTOR FUEL. L. B. Shappert (Oak Ridge National Lab., Tenn.). June 27, 1963. Contract W-7405-eng-26. 21p.

The cost of shipping spent reactor fuel from a domestic and foreign natural uranium reactor to a reprocessing

plant in the U. S. was investigated. The domestic reactor was located at Point Loma, Calif., and the spent fuel was shipped 1176 miles to Hanford, Wash. The foreign reactor was located in Italy, and the spent fuel was shipped to Southern California. Two reactors were considered: one with power of 3500 Mw(t) (case 1, domestic only) and the other was a 25,000-Mw(t) reactor (case 2). The total shipping cost was assumed to be made up of (1) freight charges, (2) depreciation charges on capital equipment, (3) handling charges, and (4) insurance charges. Each of these costs is discussed. Domestic shipping costs of spent reactor fuels, under the conditions considered, are reasonable. Shipping costs from overseas ports to the U. S. can also be reasonable, particularly if the quantity of fuel is great enough to warrant time-chartering a vessel and if it can be transported with the involvement of very little land transportation. (auth)

28447 (TID-7650) PROCEEDINGS OF THE THORIUM FUEL CYCLE SYMPOSIUM, GATLINBURG, TENNESSEE, DECEMBER 5-7, 1962. (Oak Ridge National Lab., Tenn. and American Nuclear Society, Oak Ridge, Tenn.). Contract W-7405-eng-26.

Thirty-three papers presented at the Thorium Fuel Cycle Symposium are given. Topics covered include: fuel-cycle technology, raw materials, reactor physics, and reactor concepts. Separate abstracts were prepared for each of the papers. (M.C.G.)

28448 (TID-7650(p.1-18)) OBJECTIVES AND PLANS FOR U. S. THORIUM FUEL CYCLE PROGRAMS. Frank K. Pittman (Division of Reactor Development, AEC).

The developmental problems related to economic use of thorium as a nuclear fuel are discussed. Topics covered include: economics, reactor programs, reactor physics, fuel materials, and processing and fuel fabrication. (M.C.G.)

28449 (TID-7650(p.19-28)) THE ECONOMIC MINERALOGY AND GEOLOGY OF THORIUM. Hans H. Adler (Division of Raw Materials, AEC).

The development of thorium reserves is discussed, and its dependence on the market for rare-earth metals is described. Ways of increasing low-cost resources to meet ultimate demands are outlined. The relative merits of a thorium and uranium power economy are evaluated. The problem of genesis is discussed. (M.C.G.)

28450 (TID-7650(p.29-56)) THORIUM RESERVES IN GRANITIC ROCK AND PROCESSING OF THORIUM ORES. K. B. Brown, D. J. Crouse, F. J. Hurst, and W. D. Arnold (Oak Ridge National Lab., Tenn.).

Recovery of thorium from monazite, Blind River Ores, thorite ores, and granite is described. (M.C.G.)

28451 (TID-7650(p.57-75)) A REVIEW OF THORIUM REACTOR PHYSICS. Paul R. Kasten (Oak Ridge National Lab., Tenn.).

Reactor-physics information as it applies to power-reactor evaluation is discussed, with emphasis on thorium systems. Topics covered include: special features of thorium reactors, cross sections of various nuclides, reactor calculations, and critical experiments. (M.C.G.)

28452 (TID-7650(p.76-87)) COMPARISON OF CRITICAL EXPERIMENTS AND THEORY FOR SOME THORIUM–WATER LATTICES. D. H. Roy (Babcock and Wilcox Co. Atomic Energy Div., Lynchburg, Va.).

An extensive series of critical and exponential experiments was performed with uniform lattices of fuel rods composed of fully enriched UO_2 in ThO_2. These lattices were moderated by either H_2O or mixtures of H_2O and D_2O ranging up to 82 mole % heavy water. Lattice spacings ranged from those yielding a somewhat over-moderated core to those yielding an extremely tight lattice in which more than half of the fissions were epithermal. The experimental measurements included buckling, ratio of epithermal to thermal captures in Th^{232}, ratio of epithermal to thermal fissions in U^{235}, the thermal disadvantage factor, and water height reactivity worths leading to $\partial K_{eff}/\partial \frac{1}{B}$. (auth)

28453 (TID-7650(p.88-127)) EPITHERMAL THORIUM REACTOR PHYSICS. S. G. Carpenter (Atomics International. Div. of North American Aviation, Inc., Canoga Park).

The physics of U^{233}–Th epithermal systems was studied. The Epithermal Critical Assembly is described, and the composition and sizes of 9 cores are listed. The calculations of both predicted and experimental data were made u ing a multiregion, multigroup diffusion code. Reactivity measurements, neutron importance, spectral measurements, and criticality analysis are discussed. (M.C.G.)

28454 (TID-7650(p.128-47)) SOME ASPECTS OF THE PHYSICS OF THORIUM FUELED, HIGH TEMPERATURE, GAS-COOLED REACTORS. S. Jaye (General Atomic Div. General Dynamics Corp., San Diego, Calif.).

The principal problems in the calculation of thermal spectra are discussed. The importance of spectral differences in the design of reactors is shown. Spatial variations of the thermal spectrum are illustrated. The effect of epithermal spectral hardening is discussed. Fuel utilization was calculated, and neutron economy is discussed. (M.C.G.)

28455 (TID-7650(p.148-71)) EPITHERMAL THORIUM REACTORS. D. T. Eggen (Atomics International. Div. of North American Aviation, Inc., Canoga Park, Calif.).

The results of evaluation studies on U^{233}–Th-fueled reactors, which are sodium-cooled and which operate with a spectrum in the above thermal energy range are summarized. These studies not only demonstrated the feasibility of such reactors from an engineering and materials standpoint, but also showed the potential capability for producing economic power in low fuel-cost areas. The Advanced Epithermal Thorium Reactor (AETR) concept is described. Data from epithermal critical experiments and other sources were incorporated into codes for nuclear analysis of possible AETR designs. Engineering concepts, fuel materials, safety and control, and economics were evaluated. Advantages and disadvantages of the U^{233}–Th-fueled system are listed. (M.C.G.)

28456 (TID-7650(p.172-93)) WATER COOLED THORIUM REACTORS. H. S. Barringer (Babcock and Wilcox Co. Atomic Energy Div., Lynchburg, Va.).

Several water-cooled thorium reactor concepts were developed including Spectral Shift Controlled Reactor (SSCR) and Soluble Poison Controlled Reactor (SPCR). Emphasis is placed on the thorium fuel utilization in the SSCR concept. Comparisons of nuclear parameters, fuel utilization, and fuel composition are presented for batch cycled cores and zonal cycled cores. Results showed that the SSCR offers a conversion ratio of at least 0.1 higher than the SPCR. Recycling of fuel was also found to be more attractive in the SSCR. (M.C.G.)

28457 (TID-7650(p.194-209)) MOLTEN SALT AND AQUEOUS POWER REACTORS FOR THORIUM UTILIZATION. Lloyd G. Alexander (Oak Ridge National Lab., Tenn.).

It is shown how the advantages of fluid-fuel reactors make the use of thorium economically attractive in power

reactors. Molten-salt reactors and aqueous reactors were considered. The design and economics of the Molten Salt Converter Reactor, the Molten Salt Breeder Reactor, and the Aqueous Slurry Converter Reactor are discussed. (M.C.G.)

28458 (TID-7650(p.210-43)) LIQUID METAL BREEDER REACTOR (LIMB). Robert J. Teitel (Douglas Aircraft Co., Inc., Santa Monica, Calif.).

The basic features of the Liquid Metal Breeder (LIMB) Reactor are described and preliminary evaluations of its potential with regard to breeding and economy are given. The design concepts, fuel system, blanket fluid system, coolant system, construction materials, core structure, blanket structure, heat transfer, chemical processes, converter process, breeder process, start-up procedures, breeding potential, and economical potential are discussed. (M.C.G.)

28459 (TID-7650(p.244-52)) THE DRAGON CORE. J. Blomstrand, L. Massimo, J. Schloesser, and E. Schroeder (United Kingdom Atomic Energy Authority. Reactor Group. Atomic Energy Establishment, Winfrith, Dorset, England).

The considerations that led to the proposal of a three-zone core for Dragon are discussed. This core allows the testing of fuel elements at the center under operating conditions and over long times. Material problems, especially temperature and burn-up restrictions played an important part in determining the core composition. Results of core calculations are presented. (M.C.G.)

28460 (TID-7650(p.253-84)) RADIATION HAZARDS OF RECYCLED U^{233}–THORIUM FUELS. E. D. Arnold (Oak Ridge National Lab., Tenn.).

Hazards in refabrication of U^{233}–Th fuels are discussed. Direct, semi-remote, and remote fabrication techniques are described. Alpha, gamma, and neutron activity are discussed. Activity levels were calculated for typical fuel-fabrication situations. (M.C.G.)

28461 (TID-7650(p.285-332)) PCUT—A PROGRAM FOR RECYCLE OF POWER REACTOR FUEL. J. K. Davidson, A. C. Shafer (Allis-Chalmers Mfg. Co. Atomic Energy Div., Milwaukee); G. Orsenigo, and A. Pedretti (Italy. Comitato Nazionale per l'Energia Nucleare, Rome).

The design of a pilot plant for reprocessing and fabricating reactor fuels containing thorium and uranium is described. The plant will extract usable fuel material from the spent fuel elements of a thorium–uranium reactor, reconstitute the extracted material in a suitable form, and assemble new fuel elements for use in the same reactor. Examples of some of the machines designed for use in the PCUT plant are described, along with reprocessing and refabrication cells. Waste handling is discussed. The building and the development program are described. (M.C.G.)

28462 (TID-7650(p.333-50)) THE THORIUM FUEL CYCLE DEVELOPMENT FACILITY CONCEPTUAL DESIGN. A. R. Irvine and A. L. Lotts (Oak Ridge National Lab., Tenn.).

A conceptual design for a Thorium Fuel Cycle Development Facility (TFCDF) is presented. The facility is to be capable of processing and refabrication of fuel assemblies having maximum lengths of 12 ft and which have decayed for 90 days. Four operating cells and two service cells are required to accomplish the objectives. The cells, transportation system, servomechanisms, and ventilation system are described. (M.C.G.)

28463 (TID-7650(p.351-83)) THE OAK RIDGE NATIONAL LABORATORY KILOROD FACILITY. A. L. Lotts, J. D. Sease, R. E. Brooksbank, A. R. Irvine, and F. W. Davis (Oak Ridge National Lab., Tenn.).

The ORNL Kilorod Facility was designed to provide space and equipment for performing chemical processing and fabrication operations involving U^{233} and Th. Existing facilities were extensively modified and revised to provide an improved system for solvent extraction. An existing cell was used as secondary containment for shielded cubicles which contain feed preparation and fabrication operations. The facility provides equipment for solvent extraction, for preparation of U^{233}–thorium oxide by the sol-gel technique, for loading the oxide in tubes by vibratory compaction, and for closure and inspection of the loaded fuel tubes. The facility was designed specifically for fabrication of fuel rods, approximately $\frac{1}{2}$ in. in diameter and 46 in. long, having Zircaloy-2 cladding and each containing 890 g of 3 wt % U^{233}–97 wt % Th) oxide, but it has sufficient flexibility to allow general development work on a pilot plant scale. Construction of the facility is complete, and the process equipment is being installed. (auth)

28464 (TID-7650(p.384-435)) AQUEOUS PROCESSING OF THORIUM FUELS. R. E. Blanco, L. M. Ferris, C. D. Watson, and R. H. Rainey (Oak Ridge National Lab., Tenn.).

Work on aqueous methods for processing thorium fuels is described. Mechanical decladding, shearing, core-leaching procedures, dissolution of graphite and carbide type fuels, and advanced solvent extraction methods are discussed. Objectives of the program are to develop more economical processing methods and to derive the data required to evaluate alternative recycle systems. (M.C.G.)

28465 (TID-7650(p.436-53)) SEPARATION OF IMPURITIES FROM THORIUM BY EXTRACTION WITH MAGNESIUM AND BY OXIDATION-REDUCTION REACTIONS IN A ZINC–SALT SYSTEM. Premo Chiotti (Ames Lab., Ames, Iowa).

The pyrometallurgical reprocessing of thorium–uranium fuel or blanket material is described. Thorium forms a low-melting eutectic with magnesium which contains about 40 wt % thorium. Impurities such as yttrium, rare earth, alkali and alkaline earth metals concentrate in magnesium, while protactinium, chromium, iron, niobium, molybdenum, and similar metals follow the uranium. The impurities that follow the magnesium may be extracted with KCl–LiCl eutectic. The phase relations involved in this separation were examined. Data on the equilibrium distribution of thorium and uranium between the zinc and salt phases are presented. (M.C.G.)

28466 (TID-7650(p.454-67)) ENGINEERING PROPERTIES OF THORIUM–URANIUM COMPOUNDS FOR USE IN THERMAL BREEDER REACTORS. J. A. DeMastry, A. A. Bauer, and R. F. Dickerson (Battelle Memorial Inst., Columbus, Ohio).

An investigation was made of the engineering properties of three cast thorium–uranium compounds: $(Th_9U)C$, $(Th_9U)C_2$, and $(Th_9U)B_4$. The compounds were prepared by arc melting. Pieces were cut from cylinders for metallographic examination and hardness measurements. The oxidation behavior of all three compounds was studied at temperatures between 700 and 2300°F. The carbides underwent rapid oxidation at all temperatures investigated and in most cases were completely oxidized after less than 24 hr exposure. The boride formed a protective oxide coating. The boride exhibited a steady decrease in fracture strength with increasing temperature while both of the carbides showed increased strength at higher temperatures. Thermal conductivity increased with increasing temperature. (M.C.G.)

28467 (TID-7650(p.468-97)) DEVELOPMENT OF THORIUM–URANIUM AND THORIUM–URANIUM BASE ALLOYS FOR BREEDER APPLICATIONS. M. S. Farkas, A. A. Bauer, and R. F. Dickerson (Battelle Memorial Inst., Columbus, Ohio).

Based on the potential advantages of fuel irradiation performance afforded by thorium–uranium fuels, a study was undertaken to investigate variables that might affect and also be controlled to improve this performance. A Th–10 wt % U composition was selected as the base composition for investigation. Casting, working and annealing behavior, hot hardness, tensile properties, and creep behavior are discussed. (M.C.G.)

28468 (TID-7650(p.498-518)) THORIUM–URANIUM CARBIDE FUEL DEVELOPMENT. L. Abraham (Atomics International. Div. of North American Aviation, Inc., Canoga Park, Calif.).

Properties of ThC–UC fuels were investigated. Fabrication development mixed carbide stability, mechanical properties, physical properties, and compatibility tests are discussed. It was found that the decrepitation tendencies of ThC–UC systems can be minimized by alloying with ~1 wt % of a stabilizing additive such as silicon or zirconium. Mechanical and physical property tests confirmed the suitability of this fuel for reactor application. Sodium-bonded fuel-cladding compatibility tests showed that carburizing tendencies of ThC–UC in a sodium environment are almost nonexistent until the fuel carbon content is greater than stoichiometric. (M.C.G.)

28469 (TID-7650(p.519-42)) THE SOL GEL PROCESS FOR PREPARATION OF THORIA BASE FUELS. O. C. Dean, C. C. Haws, A. T. Kleinsteuber, and J. W. Snider (Oak Ridge National Lab., Tenn.).

Progress on engineering scale-up studies and improvements in the basic procedure of the sol-gel process for preparation of thoria-base fuels are reported. The process starts with the products of the Thorex process and produces high-density thoria-base fuel suitable for loading into fuel tubes by vibratory compaction. Equipment was developed and tested for each step and is being installed in the Kilorod Facility. Thorium nitrate is denitrated in a current of superheated steam to a readily dispersible oxide product. This denitrator product is dispersed to a stable oxide sol by agitating it in dilute nitric acid or uranyl nitrate. The sol is evaporated to produce a gel. The uranyl nitrate is converted to uranium dioxide in a calcination step. The product is a completely homogeneous solid solution practically free from pores and occluded gas in which the U/Th ratio is uniform in all size fractions. (M.C.G.)

28470 (TID-7650(p.543-52)) METALLURGICAL STUDIES OF THORIUM–URANIUM–PLUTONIUM ALLOYS. B. Blumenthal (Argonne National Lab., Ill.).

Studies are being made of the constitution, properties, and radiation resistance of Pu–Th–U alloys and to evaluate them as a potential fuel for power reactors from a metallurgical fabrication, processing, nuclear, and reactor engineering point of view. Results of solid solubility and density measurements are presented. (M.C.G.)

28471 (TID-7650(p.553-84)) EXTRUSION FABRICATION OF RECYCLED THORIA–URANIA IN THE PCUT PLANT. R. S. Miller (Allis-Chalmers Mfg. Co. Atomic Energy Div., Milwaukee) and A. Liscia (Italy. Comitato Nazionale per l'Energia Nucleare, Rome).

The warm-cell design philosophy and process selection for the PCUT project of fuel reprocessing is described. Extrusion development work is summarized. The ERR (Elk River Reactor) fuel assembly designed for remote refabrication and the equipment used in the process are described. The oxide-fuel extrusion fabrication process was demonstrated to be reproducible. (M.C.G.)

28472 (TID-7650(p.585-605)) RECENT VIBRATORY-COMPACTION STUDIES ON THORIA–URANIA. W. S. Ernst, Jr. (Oak Ridge National Lab., Tenn.).

Vibratory compaction is being developed for remote fabrication of recycled Th–U oxide fuels. Six criteria were established for evaluating the process. The interaction of these criteria requires that careful consideration be given to the selection of the particle size distribution for the fuel. Because several simple size distributions yield bulk densities of approximately 90% of theoretical, the final selection for a given application can be made with respect to operational simplicity, yield, and density uniformity. (auth)

28473 (TID-7650(p.606-13)) PRELIMINARY FABRICATION INVESTIGATION OF ORNL SOL-GEL THORIA–URANIA. J. M. Kerr and T. N. Washburn (Babcock and Wilcox Co. Atomic Energy Div., Lynchburg, Va.).

Sol-gel ThO_2–3 wt % UO_2 was fabricated into rods approximately 2 ft long and 0.436 in. in diameter by both electronic and pneumatic vibratory compaction. The data obtained from density determinations and post-fabrication sieve analyses of the sol-gel oxide were compared to data obtained from rods filled with fused UO_2 by the same procedure. Densities obtained on the sol-gel oxide were consistently greater than 89% of theoretical density with electronic vibration and proper particle-size mixtures. The sol-gel oxide evidenced less than 50% the particle breakdown evidenced by fused UO_2. The sol-gel oxide was also evaluated in a swaging process and compared with fused UO_2. Fabrication characteristics as good or better than fused UO_2 were obtained. (auth)

28474 (TID-7650(p.614-29)) THORIUM IRRADIATION IN D_2O-MODERATED REACTORS. O. A. Towler, Jr. (Du Pont de Nemours (E. I.) & Co. Savannah River Plant, Aiken, S. C.).

Progress in a thorium irradiation program for U^{233} production is reported. Two different kinds of test assemblies, designated as Mark A and Mark B, were irradiated during the time the 21 tons of thorium was being procured and fabricated into shapes for reactor irradiation. The test assemblies, their characteristics under irradiation, their growth characteristics, and the resultant isotopic production in the assemblies are described. (M.C.G.)

28475 (TID-7650(p.630-42)) IRRADIATION TESTING OF THORIA–URANIA FUEL FOR THE INDIAN POINT REACTOR. W. R. DeBoskey (Babcock and Wilcox Co. Atomic Energy Div., Lynchburg, Va.).

The Indian Point Reactor irradiation program consisted of a series of loop and capsule in-pile tests on ThO_2–UO_2 fuel under conditions that equaled or exceeded the predicted Core I operating condition. Specimens were irradiated at heat fluxes ranging from 100,000 to 586,000 Btu/hr-ft^2 with little change exhibited on post-irradiation examination except for cracking. One specimen was exposed to a test reactor excursion that caused a short-term overpower of the intended experiment conditions. This overpowering resulted in void and fuel distribution changes at the pellet center. The thermal conductivity of ThO_2 was found to fall with increasing temperature. (M.C.G.)

28476 (TID-7650(p.643-74)) THORIUM FUEL CYCLE IRRADIATION PROGRAM AT THE OAK RIDGE NATIONAL LABORATORY. S. A. Rabin, M. F. Osborne, S. D. Clinton, and J. W. Ullmann (Oak Ridge National Lab., Tenn.).

The irradiation behavior of vibratory-compacted thoria-base fuels is being investigated. The materials being studied include oxide powders made by either the arc-fusion or sol-gel routes. No significant changes in the dimensions of irradiated rods were found. Fission-gas release was nearly $4\frac{1}{2}$ times lower for the sol-gel ThO_2-UO_2 than for the arc-fused oxide. There was no evidence of sintering, grain growth, or central void formation in the irradiated rods. Thermal conductivity measurements were made and studies were made of fission-gas release mechanisms. (M.C.G.)

28477 (TID-7650(p.675-95)) REACTOR IRRADIATION OF THORIA POWDERS AND PELLETS. J. P. McBride, S. D. Clinton, and W. L. Pattison (Oak Ridge National Lab., Tenn.).

As a result of reactor irradiation, crystallites in thoria powders degrade. Powders composed of small crystallites lose surface and sinter. The sintering effect becomes negligible as the x-ray crystallite size becomes >2000 Å. Particle degradation occurs in thoria powders fired at ≥1100°C. Thoria pellets which are not weakened and suffer negligible weight losses when irradiated dry in an inert atmosphere and in D_2O to an exposure of 2.5×10^{18} fissions/g can be prepared by pressing and firing techniques. Thoria pellets irradiated in D_2O vapor show pronounced surface attack and are structurally weakened. (auth)

28478 (TID-7650(p.696-720)) IN-PILE TESTING OF CIRCULATING THORIA SUSPENSIONS. E. L. Compere, H. C. Savage, A. J. Shor, and E. G. Bohlmann (Oak Ridge National Lab., Tenn.).

The effects of extensive irradiation and fission damage on the properties of a moving thoria suspension were investigated. In-pile testing of slurries of ThO_2 was carried out. Electron microscope photographs were taken of the slurries after various amounts of radiation were received. There appeared to be a chipping away at the edges of the particles with development of fines. Some agglomeration into somewhat larger particles appeared to have occurred. It was concluded that fissioning tended to produce changes within the particle but that the general breaking up of the particles required the additional element of circulation. There was an increase in surface area with total fissions. Original and unirradiated pumped material settled more rapidly than the irradiated slurries. The final settled bed was more dense in the case of the unirradiated material. (M.C.G.)

28479 (TID-7650(p.721-37)) THORIUM FUEL CYCLE ECONOMICS. M. C. Edlund (Babcock and Wilcox Co. Atomic Energy Div., Lynchburg, Va.).

Economics of the thorium fuel cycle using highly enriched uranium as the feed material are discussed. In the U^{233} recycle, starting with the reactor, the spent core is sent to a chemical reprocessing plant where the uranium is separated from the thorium and the fission products. Only the uranium is recycled. The thorium is sent to storage for approximately 12 years to permit the Th^{228} to decay. The uranium as uranyl nitrate is sent to a feed materials preparation plant where it is mixed with thorium nitrate, converted to oxide by the sol-gel process and loaded into fuel tubes. The fuel rods are assembled into bundles and the core is sent to the reactor completing the cycle. The fuel fabrication costs are estimated to be $80/kg of fuel. The thorium fuel cycle for two types of pressurized-water reactors was investigated. Costs were calculated and an average value of 1.85 mills/kw hr was obtained. (M.C.G.)

28480 (TID-7650(p.738-61)) ORNL STUDIES OF THORIUM UTILIZATION ECONOMICS. J. A. Lane (Oak Ridge National Lab., Tenn.).

Studies were carried out to evaluate the economics of thorium utilization in current generation reactors and the long range potential of thorium breeders or high-neutron-economy converters. The influence of reactivity lifetime on fuel cycle costs was determined. A comparison was made of U^{233} and Pu recycle. The importance of thorium as a long-term energy source is discussed. It is shown that the use of $U^{235}-Th$ instead of slightly enriched UO_2 in current technology reactors does not offer significant fuel-cost savings. The evaluation of reactor systems on the basis of long-term criteria indicated that the aqueous homogeneous breeder and molten salt breeder are the most promising of the reactors studied. (M.C.G.)

28481 (TID-18880) EXPERIMENTS WITH WATER-REFLECTED, UNDERMODERATED, ZIRCONIUM HYDRIDE CRITICAL ASSEMBLIES. L. I. Moss (Atomics International. Div. of North American Aviation, Inc., Canoga Park, Calif.). 1963. Contract AT(11-1)-Gen-8. 38p.

A series of critical experiments was conducted with water-reflected, undermoderated zirconium hydride assemblies. The purpose of these experiments was to evaluate the consequences of water immersion of SNAP 2/10A-type reactor cores. Critical loadings were measured with several combinations of lucite rods in vacant lattice locations, beryllium inserts, internal water, neutron poison annuli at the core-reflector interface, and ammonium pentaborate in the water supply. The reactivity worth of the upper tank water as a function of height and the incremental worth of substitution of fuel rods for lucite rods was measured by the pulsed neutron method as the loading was continued past the critical point. From these measurements, an extrapolation for the excess reactivities of fully loaded, fully water-reflected assemblies was obtained. The ratio of the effective delayed neutron fraction to the effective prompt neutron generation time (β^*) was measured for several unpoisoned configurations, employing both pulsed neutron and noise analysis methods. The two methods were in satisfactory agreement, giving a best value of 4.76×10^2 sec^{-1}. The corresponding value for the beryllium-reflected reactor was measured as 1.38×10^3 sec^{-1}. The much greater β^* for the water-reflected assembly is attributable to reflector delayed neutrons. (auth)

28482 (TID-18888) EXPERIMENTAL GAS COOLED REACTOR STRAIN MEASUREMENTS AND ANALYSES, STRAIN GAGE WATERPROOFING AND INSTRUMENTATION FOR PRESSURE VESSEL. Basilius Hud (Baldwin-Lima-Hamilton Corp., Philadelphia). [Apr. 17, 1963]. Contract [AT(40-1)-2014]. 90p.

Hydrostatic tests were performed on the EGCR pressure vessel in order to determine its adequacy for withstanding the design loads. The results of strain measurements are summarized. The installation of the Bakelite strain gage rosettes is described in detail, and the techniques used to analyze the gage data are given. (D.L.C.)

28483 (TID-18895) MEASUREMENTS OF BUCKLINGS AND VOID EFFECTS IN D_2O MODERATED, ORGANIC OR H_2O COOLED, LATTICES OF UO_2 ROD CLUSTERS. F. D. Benton and W. E. Graves (Du Pont de Nemours (E. I.) & Co. Savannah River Lab., Aiken, S. C.). June 1963. Contract AT(07-2)-1. 17p.

Buckling and void effects in UO_2 rod clusters were measured. The fuel assemblies and organic and H_2O coolants were chosen to cover an extreme range of hydrogenous coolant properties. The measurements were performed in the D_2O-moderated Process Development Pile. The fuel assemblies consisted of 19, 31, or 37 UO_2 rods. The rods were made up of sintered pellets stacked in aluminum tubes. Bucklings were determined by the substitution method, in which the fuel assemblies to be measured replaced assemblies in a one-region lattice of known nuclear properties. Two analysis techniques were used: a one-group perturbation method and a two-group flux matching method. Results of measurements are given in tabular form. (M.C.G.)

28484 (TID-18911) ELECTROSTATIC PURIFICATION OF HELIUM REACTOR-COOLANT. Harlan Shaw (Tracerlab. Div. of Lab. for Electronics, Inc., Richmond, Calif.). Apr. 5, 1963. Contract AT(04-3)-341. 127p. (TLW-1082).

Helium-coolant contamination and contaminant removal techniques are discussed. An electrostatic technique is proposed, based on the idea that the creation of ions in helium gas will result in a larger ratio of contaminant ions to helium ions than the corresponding molecular ratio existing in the un-ionized coolant, and that these ions can then be removed by the sweeping action of an electric field into a bypass line. The result is an increase in contaminant concentration, in a fraction of the total flow. Principles of operation and application to a reactor are described. An open-cycle feasibility study and a closed-cycle study at reactor pressures are discussed. Results showed the feasibility of the concept at atmospheric pressure, and indicated that practical separations were obtainable under those conditions. Closed-cycle studies were not completed, but the calculations indicated reactor application of the electrostatic technique is possible. (M.C.G.)

28485 (WAPD-T-1376) A REVIEW OF METHODS FOR DESCRIBING THE DETAILED TIME BEHAVIOR OF REACTORS. A. F. Henry (Westinghouse Electric Corp. Bettis Atomic Power Lab., Pittsburgh). Sept. 1961. Contract AT(11-1)-Gen-14. 18p.

Methods used to describe various phenomena in reactors are briefly reviewed. The phenomena are arranged according to the time range over which they are pertinent by the classification system: days-to-years, minutes-to-days, milliseconds-to-minutes, and microseconds-to-milliseconds. Aspects involved in describing the phenomena are discussed, and some attempts are made to compare the effectiveness of different models for a given phenomenon. (D.C.W.)

28486 TRANSFER FUNCTION FROM REACTOR NOISE. E. K. Hoekstra. Atoomenergie Haar Toepassingen, 5: 91-5(May 1963). (In Dutch)

A new technique with which the dynamic behavior of reactors can be determined rapidly without perturbing the reactor operation makes use of "white" noise as a strong signal of the control rod. The fluctuations occurring in the neutron flux were measured, and then both signals were subjected to a correlation analysis. (tr-auth)

28487 PRINCIPLES AND LAWS DETERMINING THE OPERATIONAL SAFETY OF NUCLEAR INSTALLATIONS. W. E. Johnson (Westinghouse Electric Corp., [Madrid]). CENUSA (Bol. Centrales Nucl., Soc. Anon., No. 38, 9-19 (Oct.-Dec. 1962). (In Spanish)

The positive steps taken to limit the consequences of serious accidents at nuclear installations are reviewed. The history of the concept of site selection and of the development of containment is discussed. The limitations of these concepts are indicated. Three new systems now under study and development – the reduced pressure system, zero escape system, and a system using the techniques of boxed foundations – are described. (J.S.R.)

28488 THE PROGRAM FOR THE TESTING OF EQUIPMENT AND MECHANICAL COMPONENTS IN ORGANIC LIQUIDS. Giovanni Elvio Farello and Rinaldo Zona. Comit. Nazl. Energia Nucl., Notiziario, 9: No. 5, 37-48(May 1963). (In Italian)

A program for organic liquid tests on the equipment and mechanical components for use in the P.R.O. design work is described. The loop used in the testing and some of the results obtained for valves, seals, gaskets, flanges, and turbine rotors are discussed. (J.S.R.)

28489 MEASUREMENT OF LOW REACTIVITIES BY SINUSOIDAL MODULATION OF THE SOURCE. Maurice Surdin, Constantin Kassimatis, and Jean Valat. Compt. Rend., 256: 3845-6(Apr. 29, 1963). (In French)

A method for the measurement of the reactivity of a subcritical reactor is described. The reactivity is obtained beginning with the measurement of the phase difference between the modulation of the source and the modulation resulting from the number of neutrons in the reactor. (tr-auth)

28490 TRANSFER FUNCTION SYNTHESIS AS A RATIO OF TWO COMPLEX POLYNOMIALS. C. K. Sanathanan and J. Koerner (Argonne National Lab., Ill.). IEEE (Inst. Elec. Electron. Engrs.), Trans. Autom. Control, AC-8: 56-8(Jan. 1963). (TID-17481; UAC-6850)

Experimental frequency response data obtained from a linear dynamic system is processed to obtain the transfer function as a ratio of two frequency-dependent polynomials. The difference between the absolute magnitudes of the actual function and the polynomial ratio is the error considered. The polynomial coefficients are evaluated as the result of minimizing the sum of the squares of the above errors at the experimental points. The polynomial coefficients are computed numerically using an IBM 704 FORTRAN program. The magnitude and phase angle of the transfer function are evaluated at the various frequencies, using the computed polynomial ratio; and are compared with the observed data. The method gives an analytic description of the complex transfer function superior to that given by minimization of the weighted sum of the squares of the errors in magnitude. (auth)

28491 BOUNDARY CONDITIONS AT THE SURFACE OF HOLLOW SLOWING-DOWN CONTROL RODS IN THREE-GROUP THEORY. H. Heinrich (VEB EPkA, Berlin). Kernenergie, 6: 146-51(Apr. 1963). (In German)

A method for the calculation of boundary conditions for the flux at the surface of a hollow, cylindrical control rod, which contains a moderating substance inside, was developed in the frame of the three-group diffusion theory. The cladding of the rod was assumed to be nonslowing. The effects of the neutron flux and flow through the cladding are described by transition probabilities, which are calculated by the principles of the transport theory. No assumptions were made about the scattering and absorption properties of the cladding. (tr-auth)

28492 NEUTRON FLUX AND NEUTRON DOSE. B. Hasenclever. Kerntechnik, 5: 226-9(May 1963). (In German)

Methods of calculating and detecting neutron flux in a reactor and neutron dose are discussed. The energy dis-

tribution of the neutron flux, including fast, resonance, and thermal fluxes, is described. (M.C.G.)

28493 STEELS CONTAINING BORON FOR NUCLEAR TECHNIQUE. Jaroslav Vrtěl. Mater. Sb., Statni Vyzkum. Ustav Mater. Tech., 1959, 115-64(1960).

Results of experiments with steels and cast irons containing 1 to 5% B are reported. Addition of Cr improved strength but reduced ductility. However it considerably improved the mechanical properties at 300°C. The notch-bar test of toughness of steels containing more than 1% B yielded low values (owing to the presence of Al in the alloy). The decrease in toughness depends also on the C content. Increase in C content enhances the effect of Al on decreasing the toughness. In steels containing more than 2.5% B and more than 0.1% C no transformation occurs that would substantially improve the mechanical properties of the steel. It is advantageous to heat treat the B-containing steel castings at 920–950°C for 1 hr and to anneal them at 680°C for 10 hrs. This improves the homogeneity of the steel. Metallographic, chemical and x-ray studies, and thermal analysis of steels with varying B content show that the present borides do not affect the metallic matrix. Carbon enters into reaction with B and Fe forming complex fero-boro-carbides of the type $Fe_{23}(C,B)_6$, which accompany Fe borides alloyed with Al and Cr. Al and Cr also take part in alloying of solid solution of α iron (at low C content). Cr improves the mechanical properties of B steels at elevated temperatures, stabilizes the B-containing components, and increases the steel resistance towards atmospheric corrosion. The steel for heat protection of reactors had the composition: C = 0.1%, B = 2.0 to 2.5%, Al = 2.0 to 2.5%, Cr = 3.0 to 3.5%, Ti = 1 to 1.2%. (TCO)

28494 RESPONSE MATRIX METHOD. Akinao Shimizu (NAIG Nuclear Research Lab., [Japan]). Nippon Genshiryoku Gakkaishi, 5: 359-68(May 1963). (In English)

A new method for estimating the criticality of multiregion reactors was developed. A spatial region was regarded as a black box which responds to the incident current of neutrons and gives the reflected current and the transmitted one as outputs and the response matrices were introduced as the basic quantity representing the effect of a spatial region to the behavior of neutrons in the reactor. Then it was shown by deriving the combination rule of response matrices of regions and the criticality equation by means of those matrices that the criticality of multiregion reactors can be determined if the response matrices of regions are known. The method is useful, since the response matrices of a region can be calculated more easily than the flux in a multiregion reactor because the calculation of those matrices is reduced to a boundary value problem of a bare homogeneous region and also may be determined by direct measurements. The method was extended to time-dependent problems and the equation for the period of a multiregion reactor was also derived. (auth)

28495 APPLICATION OF THE RESPONSE MATRIX METHOD TO CRITICALITY CALCULATIONS OF ONE-DIMENSIONAL REACTORS. Akinao Shimizu, Kazuo Monta, and Toshiki Miyamoto (NAIG Nuclear Research Lab., [Japan]). Nippon Genshiryoku Gakkaishi, 5: 369-76 (May 1963). (In English)

The response matrix method was successfully applied to problems to solve the multigroup diffusion equation for one-dimensional multiregion reactors. The method consists of the calculation of response matrices of spatial regions, which is reduced to a boundary value problem for a bare homogeneous region and can be performed analytically, and of the criticality calculation by means of response matrices, which can be performed by simple algebra involving matrices even for reactors consisting of many spatial regions, since the order of matrices involved is equal to the number of energy groups independently of the number of spatial regions. By a numerical calculation it was confirmed that the method gives the accurate solution and that the execution time of the machine is appreciably less than that by the finite difference method for few-group calculations. Criticality calculations by means of an electronic analog computer were also performed. It was shown that the analog calculation gives us the multiplication factor of two-region reactors with an error less than 0.1% by simple procedures. (auth)

28496 TRANSIENT HEAT TRANSFER IN THE HETEROGENEOUS WATER REACTOR. [PART] I. Shigenori Hayashi (Kyoto Univ.), Akira Sakurai, and Tetsuo Iwazumi. Nippon Genshiryoku Gakkaishi, 5: 403-11(May 1963). (In Japanese)

When a sudden excess reactivity is introduced into a heterogeneous water reactor, the reactor power increases as an exponential function and the fuel element temperature rises rapidly. In many reactors, however, the reactor power does not infinitely increase as an exponential function, but self-shutdown will be induced by the thermal energy increase in the reactor with increasing reactor power. Finally, the reactor power ceases to increase. As fundamental problems in the analysis of these reactor kinetics, experimental and theoretical studies were performed on the transient heat transfer between the fuel and the coolant when the reactor power increased exponentially. The methods applying the above mentioned results to the analysis of the reactor kinetics during a power excursion were also shown. The experiments showed a good agreement with the analysis. (auth)

28497 EGCR OPERATIONAL REFUELLING. Harold D. Young (Kaiser Engineers, Oakland, Calif.). Nucl. Eng., 8: 6p.(Feb. 1963).

The charge machine for refuelling the Experimental Gas Cooled Reactor (EGCR), now being constructed at Oak Ridge, Tennessee, is the first for operational refueling in the U. S. It is designed to impose no disturbance to the continuous operation of the reactor. Indeed, certain of its features are intended to forestall or correct disturbances from other causes. (auth)

28498 RECONDITIONING THE BROOKHAVEN GRAPHITE REACTOR FUEL-STORAGE CANAL. A. F. Humm, Jr. and S. R. Protter (Brookhaven National Lab., Upton N. Y.). Nucleonics, 21: No. 6, 96; 98(June 1963).

The precautions and procedures followed in removing and replacing the contaminated paint in the spent-fuel storage canal are described. Repainting and decontamination of the canal reduced average dose rates from 1.5–3 rads/hr to 20–60 mrads/hr. The contamination resulted mainly from the chopping of fuel elements in the canal. (D.C.W.)

28499 A LARGE DESALINIZATION REACTOR BASED ON CURRENT TECHNOLOGY. Irving Spiewak (Oak Ridge National Lab., Tenn.). Nucleonics, 21: No. 7, 64; 66; 68 (July 1963).

A reference design for a reactor desalinization and power generation plant (particularly, the reactor design) is presented. The facility, based on current technology, would use three 8,333-Mwt heavy-water moderated, boiling-light-water-cooled reactors fueled with natural UO_2 to provide 4,500 Mwe of electricity and 2 billion gallons of water per day. Cost estimates for construction and operation are also included. (D.C.W.)

28500 REACTOR RADIATION LOOPS AS LARGE GAMMA SOURCES. Yu. S. Ryabukhin, et al. IAEA Preprint CN-14/60. 47p. (In Russian)

To be published in Proceedings of the IAEA Conference on the Application of Large Radiation Sources in Industry, Salzburg, Austria, May 1963.

Methods for calculating radiation loop systems were worked out and the possibilities of various gamma carriers examined. Indium alloy loops, liquid at room temperature, were first selected for practical experiment. The behavior of two eutectic In alloys was studied in relation to certain constructional materials and at the beginning of 1960 the first test In–Ga loop was operated. Further work led to the installation of a model In–Ga loop in the IRT reactor with an irradiation source activity of ~100 g equiv. and a test In–Ga–Sn loop in a channel of the IRT reactor. Finally in 1962, a pilot In–Ga–Sn loop for semi-industrial radiation processes was put into service; its maximum irradiation source activity was 30,000 g equiv. (P.C.H.)

28501 NUCLEAR FUEL HANDLING. A. D. Wordsworth. London, Butterworths, 1963. 177p. $15.00.

A book is presented on the requirements of nuclear fuel handling procedures and equipment. The book is divided into two parts, one dealing with the general requirements, purposes, and principles, and the other giving details of many reactor installations for comparisons between different types of equipment. The emphasis is on on-load refuelling, although off-load refuelling is also considered. (D.L.C.)

28502 SPERT I CAPSULE EXPERIMENT (Engineering Materials). (Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho). 14 units. (CAPE-985)

The in-pile capsule program was designed to investigate the characteristics of the boiling process in relation to moderator expulsion from the region surrounding the fuel plates during the course of a power excursion. Factors studied were radiolytic gas, boiling effects, water volume, water pressure, and moderator displacement. (F.E.S.)

28503 IMPROVEMENTS IN OR RELATING TO NUCLEAR REACTOR FUEL ELEMENTS. Brian Vernon Gaskell (to United Kingdom Atomic Energy Authority). British Patent 927,728. June 6, 1963. Filed Apr. 17, 1961.

A fuel element composed of a natural or enriched uranium fuel member of elongate form with its open ends plugged by uranium depleted in U^{235} is described. The fuel member is enclosed in a protective sheath, and the element is adapted for assembly with similar fuel elements in end to end relation in rows or columns. (D.C.W.)

28504 IMPROVEMENTS IN OR RELATING TO FUEL ELEMENT AND CONTROL ROD HANDLING APPARATUS FOR NUCLEAR REACTORS. (to General Dynamics Corp.). British Patent 927,782. June 6, 1963. Priority date Dec. 14, 1960, United States.

An apparatus for handling, loading, or unloading control rods and fuel elements for a reactor with a vertically extending pressure vessel is described. The unit consists of a housing that mounts above the vessel and in which a grappling structure is mounted on an arm that is supported by vertically extended frame sections attached to the housing. The arm can be moved from a vertical position against the wall to a horizontal position over the vessel; the grappler moves along the arm and rotates relative to the arm about a vertical axis. (D.C.W.)

28505 IMPROVEMENTS IN OR RELATING TO ENERGY ABSORBING DEVICES. Ivor Kent and Colin Atkinson (to United Kingdom Atomic Energy Authority). British Patent 928,111. June 6, 1963. Filed May 8, 1960.

The energy of bodies (control rods or fuel elements, for instance) falling within a nuclear reactor can be absorbed by mounting a deformable tube with a flared end on the body so that a stationary nondeforming tube with an enlarged head enters and deforms the falling tube. Mounting the movable tube by shears pins gives additional protection for large impacts. (D.C.W.)

28506 IMPROVEMENTS IN AND RELATING TO PRESSURISED WATER REACTORS. Alan Bell and Arthur Charles Lawrence (to Foster Wheeler Ltd.). British Patent 928,201. June 12, 1963. Filed Jan. 30, 1961.

The apertures in the walls of a pressurized water reactor through which pass the heater pipes are designed in such a way so as to allow clearance so that there is no crack or crevice between the heater and the pressurizer wall that can become contaminated with radioactive material. The hole in the pressurizer wall is bounded beneath the heater by an inwardly and downwardly sloping surface so that when the pressurizer is drained, the water will flow out of the hole by gravity. (C.E.S.)

28507 IMPROVEMENTS RELATING TO GAS-SAMPLING MEANS FOR A GAS-COOLED NUCLEAR REACTOR. Donald George McCulloch (to A. Reyrolle & Co. Ltd.). British Patent 928,216. June 12, 1963. Filed Sept. 1, 1958.

A gas sampling selector system with valves connected to the fuel channels of the reactor core that withdraw gas samples and supplies them to a fission products detector is described. Electrical systems that respond to radioactivity and temperature changes are included. Alarm systems for malfunctioning of the system are also presented. (C.E.S.)

28508 IMPROVEMENTS IN OR RELATING TO ORGANIC LIQUID MODERATED AND COOLED NUCLEAR REACTORS. Kenneth Maddocks and John Alan Dodd (to United Kingdom Atomic Energy Authority). British Patent 928,236. June 12, 1963. Filed Nov. 22, 1960.

An arrangement in which organic liquid cooled and moderated reactors using terphenyls would have two separate liquid circuits passing through the core is described. One circuit of terphenyl having a 50% content of the high molecular weight substances formed in terphenyl by irradiation would serve as the moderator while the other (coolant) circuit would contain 30% of the heavier substances, thereby lowering pumping power requirements on this circuit. (D.C.W.)

28509 IMPROVEMENTS IN OR RELATING TO FUEL ELEMENT ASSEMBLIES. David Colin Emerson (to United Kingdom Atomic Energy Authority). British Patent 928,394. June 12, 1963. Filed Oct. 21, 1959.

Suspension of fuel rods within a tubular fuel assembly by thin plate-like support members resting on the uppermost of a series of grid members formed by intersecting webs disposed edge-wise to the coolant flow and attached to the housing relieves the rods of compressive forces and permits good coolant flow. The lattice defined by the webs locates the rods, gives freedom for expansion, and avoids chatter and vibration. (D.C.W.)

28510 IMPROVEMENTS IN OR RELATING TO MODERATOR CORE STRUCTURES FOR NUCLEAR REACTORS. Michael Adolf Bayer and Michael Carl Hartnell-Beavis (to General Electric Co. Ltd.). British Patent 928,414. June 12, 1963. Filed June 22, 1959.

A system of tile members, keys, and keyways can be

used to stabilize moderator cores composed of graphite blocks against contraction and expansion under irradiation. The blocks and the tile members that separate at least some of the blocks in each line are connected by the keys and keyways. Fuel channel alignment is maintained against contraction, expansion, or shocks such as earthquakes. (D.C.W.)

28511 IMPROVEMENTS IN AND RELATING TO FUEL ELEMENTS FOR NUCLEAR REACTORS. Arthur Gray Robson (to C. A. Parsons & Co. Ltd.). British Patent 928,517. June 12, 1963. Filed Jan. 21, 1959.

Enclosure of reactor fuel in ceramic or cermet form in a cylinder of porous material (graphite or graphite-ceramic) around which the containing metal membrane is placed provides voidage for the fission product gases and gives structural strength to the fuel element so formed. Pressure buildup inside the element is prevented, and the metal container can be made thinner. (D.C.W.)

28512 IMPROVEMENTS IN AND RELATING TO THERMOCOUPLE ARRANGEMENTS FOR NUCLEAR REACTOR FUEL ELEMENTS. Robin Arthur Underwood and Ian Laird McKenzie Paterson (to C. A. Parsons & Co., Ltd.; Nuclear Power Plant Co., Ltd.; and A.E.I.-John Thompson Nuclear Energy Co., Ltd.). British Patent 929,126. June 19, 1963. Filed May 2, 1961.

A thermocouple cable arrangement is designed in which the cables break at points near the fuel elements upon the application of a lifting load to the contact box. In the arrangement, each cable passes through a device attached to the fuel element, with a portion of its sheath within the device removed and the bare portion covered by a tensile weak link of tensile strength lower than that of the sheath. Thus, the link is the first to break when the cable is lifted, and substantially all the cables can be removed from the channels prior to the removal of fuel elements. (D.L.C.)

28513 IMPROVEMENTS IN AND RELATING TO NUCLEAR REACTOR CONTROL ROD WINDING MECHANISMS. John Freer (to English Electric Co., Ltd.). British Patent 929,174. June 19, 1963. Filed Sept. 19, 1958.

A control rod winding mechanism is designed for gas-cooled graphite-moderated reactors. The mechanism comprises a winding drum journalled in a supporting structure for winding a cable on to and off a spirally grooved outer surface of the drum, means for causing the drum to move along its axis of rotation so that the cable pay-off position is kept stationary, and pulley means for guiding the cable on to and off the drum. The driving means comprises a constant-speed motor coupled to the drum through a variable ratio gear unit. The gear ratio is varied to produce a constant rate of reactivity change as the drum moves axially. (D.L.C.)

28514 IMPROVEMENTS IN AND RELATING TO NUCLEAR REACTOR VESSELS. Linden Cyril Laming (to Foster Wheeler Ltd.). British Patent 929,689. June 26, 1963. Filed Mar. 13, 1961.

A reactor vessel is designed in which the shield for protecting the wall from radiation is made up of segments which can be inserted and withdrawn through an opening in the top of the vessel. The segments are fitted together with chevron joints to form two coaxial rings supported at the bottom by engagement with notched plates and held in position at the top by a sleeve. (D.L.C.)

28515 IMPROVEMENTS IN AND RELATING TO NUCLEAR REACTORS. Graham Frederick Butler and William Paul Engleheart (to Nuclear Power Plant Co., Ltd.). British Patent 929,838. June 26, 1963. Filed Dec. 7, 1959.

A burst slug detection system is designed, which consists of means for continuously analyzing mixed samples of coolant fluids from groups of fuel channels, together with means for analyzing the coolant fluid from individual channels of a group. The detection system is synchronized with a print-out device to provide a record of the alarms registered during the scanning of the channels. (B.O.G.)

28516 IMPROVED MECHANICAL JOINT. Alan Bell (to Foster Wheeler Ltd.). British Patent 929,882. June 26, 1963. Filed Jan. 14, 1960.

Methods are described for joining a motor support tube of a reactor control rod drive unit to the wall of a reactor containment vessel, through which the control rod passes, either perpendicularly of obliquely to the wall. The joints for both methods are rendered leak-proof by seal welding. (B.O.G.)

28517 GAS HANDLING SYSTEMS FOR RADIOACTIVE GASES. Joel Weisman and Maurice Griffel (to Westinghouse Electric Corp.). U. S. Patent 3,093,564. June 11, 1963. Filed Oct. 21, 1957.

An arrangement and method for separating and eliminating radioactive gases from reactors is described. After separation of valuable gases, the unwanted gases are adsorbed in charcoal beds to permit their radioactivity to decay to a reasonable level. The gases are then vented to the atmosphere. Provision is made for cyclical operation of the beds to give maximum adsorption and decay and for cooling and holding the gases. (D.C.W.)

28518 NUCLEAR REACTORS. Gwillym John Blockley and George Oliver Jackson (to United Kingdom Atomic Energy Authority). U. S. Patent 3,093,565. June 11, 1963. Priority date Oct. 4, 1957, Great Britain.

A liquid moderated gas cooled reactor employing re-entrant type cooling and having two groups of thimble ended core tubes entering a moderator containment tank in which the tubes in symmetrical lattices entering from one direction intermesh with a similar group of tubes from the other direction to form a symmetrical lattice is described. The two lattices have pitch $L/\sqrt{2}$ and intermesh to form a pitch L lattice. This arrangement facilitates gas connections to the core tubes outside the moderator tank. (D.C.W.)

28519 MODERATOR CORE STRUCTURES FOR NUCLEAR REACTORS. Harry Albert Cox (to General Electric Co., Ltd.). U. S. Patent 3,093,586. June 11, 1963. Priority date Sept. 25, 1959, Great Britain.

A technique for stabilizing reactor cores composed of lines of graphite blocks against lattice spacing changes due to shrinkage by positioning the blocks relative to one another by corner keys and side face keys and by connecting the blocks with spacing units is described. Lattice spacing is stabilized by the keys and by tile members either integral with, or located relative to, the spacing units. (D.C.W.)

28520 FUEL-ROD STRUCTURE FOR HETEROGENEOUS NUCLEAR REACTORS. Walter Humbach (to Siemens-Schuckertwerke Aktiengesellschaft). U. S. Patent 3,094,473. June 18, 1963. Filed Oct. 16, 1958.

A heterogeneous reactor fuel-rod lattice is designed which approaches the ideal lattice design more closely than heretofore possible. The lattice comprises three subassemblies of fuel rods, each subassembly being perpendicular to the others, and inlet and outlet conduits which provide three series-connected coolant flow paths along the fuel rods. (D.L.C.)

Power Reactors

Refer also to abstract 28572.

28521 (ACNP-6112(Rev.1)) PATHFINDER ATOMIC POWER PLANT. PROGRAM AND ORGANIZATION FOR PREOPERATIONAL AND NUCLEAR TESTING. (Northern States Power Co., Minneapolis and Allis-Chalmers Mfg. Co. Atomic Energy Div., Milwaukee). May 15, 1963. 70p.

The preoperational and initial startup programs are described. The organization for the initial startup program is given along with experience resumés of the personnel involved. (N.W.R.)

28522 (ACNP-62030) PATHFINDER ATOMIC POWER PLANT. SUPERHEATED STEAM HEAT TRANSFER AND PRESSURE DROP EXPERIMENTS. K. F. Neusen, G. J. Kangas, and N. C. Sher (Allis-Chalmers Mfg. Co. Atomic Energy Div., Milwaukee). May 15, 1963. For Northern States Power Co., Minneapolis and Central Utilities Atomic Power Associates. Contract AT(11-1)-589. 37p.

Heat transfer and pressure drop in a Pathfinder nuclear superheater fuel element is studied by simulating tests in a long, thin annular passage, which is heated both internally and externally, spaced with longitudinal spacers. Heineman's correlation of Nusselt number $L/D_e > 60$ appears to be appropriate for superheated steam in a thin annulus with both walls heated. The friction factors are satisfactorily described by the smooth Moody curve if film temperature properties are used. Measured film coefficients are about the same on the inner and outer walls. The L/D_e effect is negligible for large values. It is shown that annular geometry with longitudinal wire spacers is amenable to treatment with the equivalent diameter concept. (N.W.R.)

28523 (CVNA-181) CAROLINAS VIRGINIA NUCLEAR POWER ASSOCIATES, INC., RESEARCH AND DEVELOPMENT PROGRAM QUARTERLY PROGRESS REPORT FOR THE PERIOD JANUARY–MARCH 1963. (Westinghouse Electric Corp. Atomic Power Div., Pittsburgh). Contract AT(30-1)-2289. 43p.

Research and development progress is reported on the Carolinas-Virginia Tube Reactor. Topics covered include: study of primary coolant system pressure drops, study of reactor transients, radiation analysis, thermal and hydraulic core tests, plant nuclear evaluation, ultrasonic inspection of pressure tubes, and metallurgical examination of CVTR components. (N.W.R.)

28524 (DLCS-4000201(Rev.)) AUTOMATIC DATA LOGGING AND COMPUTING SYSTEM SIMULATED OPERATING TEST. Test Evaluation. Core I, Seed 2. (Duquesne Light Co., Shippingport, Penna.). First Issue, Feb. 9, 1962. Second Issue, May 17, 1963. Contract AT (11-1)-292. 22p.

Tests were made to check the adequacy and completeness of the logging program for the automatic data logging and computing system and the ability of the system to measure core flows and temperatures using existing transducers. The thermocouple reference junction box temperatures were found to fall within the design ratings of 150.0 ± 0.1°F after making adjustments to the verniers of the reference temperature. The linearity tests were completed successfully for all points. The computer appears to be linear over the entire range of high d-c, a-c, core flow, type J–Tc and type K–Tc input signals. For runs number one and two, all points were successfully punched out on the IBM card punch at log numbers 1, 25, and 50. Only the first punch run was obtained in run number three due to a malfunction in the card punch. (auth)

28525 (DLCS-5000463) MONTHLY OPERATING REPORT, APRIL 1963. (Duquesne Light Co., Shippingport, Penna.). Contract AT(11-1)-292. 38p.

The station generated continuously throughout April, maintaining a gross output of 68 Mw at 100% reactor power. Of significance was the isolation of the 1A reactor coolant loop due to leakage of the 1A feedwater regulating valve. A radioactive spill occurred in the radiochemistry laboratory; however, the contamination created by the spill was removed by an effective cleanup method which reduced the levels to acceptable limits. Three tests were completed during April, and there were three tests still in progress at the end of the month. Twenty-one test procedures, 11 test evaluations, and five preliminary reports were prepared and issued. The nuclear power stations training program was activated April 29 with class No. 7 consisting of 13 students. Review training for the operations supervisors, initiated last month, continued during April. Construction and plant modifications consisted of work on the HDS, reactor plant fire protection sprinkler system, RWDS level instrumentation and the decontamination system. (auth)

28526 (DP-845) HEAVY WATER MODERATED POWER REACTORS. Progress Report, March–April 1963. L. Isakoff, comp. (Du Pont de Nemours (E. I.) & Co. Atomic Energy Div., Wilmington, Del.). May 1963. Contract AT(07-2)-1. 32p.

An evaluation of the status of heavy-water-moderated reactors as of March 1963 concludes that these reactors are attractive for development and commercialization in the U. S. nuclear power program. By virtue of their excellent neutron economy and their ability to operate on simple, massive, low-cost fuel elements, these reactors offer the potential of energy generation costs that are lower than those attainable in other converter reactors, higher conversion ratios than any other converter reactor, a breeding cycle with thorium fuel, and low-cost steam for process heat applications such as desalination. Failure of an oxide fuel tube occurred in the HWCTR due to an as yet undiscovered cause. During March the reactor had operated at a power level of about 40 Mw for 96.7% of the month. The maximum exposure achieved satisfactorily by the mechanically compacted oxide tubes under test in HWCTR was 6600 Mwd/t U. Examination of sound metal tubes removed from the HWCTR after relatively short exposures revealed significant amounts of fretting corrosion, indicating that this was the probable cause of the two failures of uranium metal tubes that occurred during earlier HWCTR irradiations. (auth)

28527 (GEAP-3828) N. S. SAVANNAH FUEL DESIGN AND DEVELOPMENT PROGRAM. FINAL EVALUATION OF THE THERMAL-HYDRAULIC PERFORMANCE OF CORE II. A. P. Bray (General Electric Co. Atomic Power Equipment Dept., San Jose, Calif.). Oct. 1962. Contract AT(04-3)-189. 45p.

A review of the thermal-hydraulic analysis of the N. S. Savannah Core II was conducted in two phases. Phase I involved the determination of the third-pass coolant flow rate, and Phase II involved the evaluation of third-pass thermal performance. The review indicates that the thermal-hydrulic performance is acceptable. The Core appears to behave efficiently in the primary system. The flow rate is larger than in the case of Core I, and the minimum burnout ratio, even at 150% power, is more than

adequate. The review also indicates that previous analyses of the Core II performance were conducted on a justifiable basis. The thermal and hydraulic analyses reported are based on B&W analyses of the N. S. Savannah primary system. Should their analyses in any way become non-applicable, this analysis would also be non-applicable. (auth)

28528 (IDO-28607) ARMY GAS-COOLED REACTOR SYSTEMS PROGRAM. Quarterly Progress Report, January 1, through March 31, 1963. (Aerojet-General Nucleonics, San Ramon, Calif.). May 15, 1963. Contract AT(10-1)-880. 66p.

The scheduled modification of the ML-1 power plant was completed and the plant was operated continuously for 101.3 hr. The maximum reactor power was 3.2 Mw(t) and the maximum shaft output power was 252 kw. The plant performed essentially as predicted. The tube sheets temperatures were lower than predicted, indicating that the bypass flow corrective modification was successful. Evidence of a leak between the process gas and moderator systems was observed shortly after shutdown. Investigation confirmed the presence of a leak in the lower plenum and a program for partial disassembly of the reactor to locate and repair the leak was initiated. The TCS 670A failed during open cycle testing because of insufficient clearances in the turbine. A program of modification and repair was initiated. The development testing of the alternator was essentially completed; the alternator will deliver 400 kw with a 45 kvar per phase external capacitance. Start motor development was completed. The investigation of the embrittlement of the IB-8T-1 fuel pin cladding continued. It was tentatively concluded that the X-phase formation resulted from nitrogen inside the pins. No evidence of X-phase was found in preliminary examinations of IB-8T-2 cladding. The IB-17R (ML-1-II prototype) in-pile tests were initiated. (auth)

28529 (KR-45) AN ANALOGUE COMPUTER MODEL FOR THE DYNAMICS OF THE HALDEN-I REACTOR. P. la Cour Christensen and K. Solberg (Norway. Institutt for Atomenergi, Kjeller). Apr. 1963. 51p.

A nonlinear mathematical model of HBWR with first fuel charge was developed to permit computer studies of the dynamics of the reactor. The model includes neutron kinetic equations, heat transfer equations, and hydrodynamic and steam load models. The equations and their solution are discussed, along with checks on the model. Results obtained with the model are presented that show the model describes the dynamic behavior for both reactivity and load perturbations rather well. (D.C.W.)

28530 (NP-12909) GARIGLIANO NUCLEAR POWER PLANT. Technical Report, December 31, 1962. (Società Elettronucleare Nazionale, Rome). 55p.

Construction progress on the Garigliano nuclear power plant is reported. Information is included on scheduling, design drawings, and developments. (N.W.R.)

28531 (ORNL-3437) FABRICATION DEVELOPMENT OF U–Mo–UO_2 AND U–Mo–UC DISPERSION FUELS FOR THE ENRICO FERMI FAST-BREEDER REACTOR. S. A. Rabin, M. M. Martin, A. L. Lotts, and J. P. Hammond (Oak Ridge National Lab., Tenn.). June 24, 1963. Contract W-7405-eng-26. 49p.

The fabricability of dispersion fuels using UO_2 or UC as the dispersoid and uranium combined with 10 to 15 wt % Mo as the matrix was investigated. Cores containing 17.8 wt % UO_2 dispersed in U–15 wt % Mo were successfully fabricated to about 80% of theoretical density by cold pressing at 50 tsi, sintering at 1100°C, and cold coining at 50 tsi. Comparable results were obtained with UC as the dispersoid. Core fabrication results varied greatly with the type of matrix powder used. Occluded gases, pour density, and surface cleanliness bore important relations to the fabrication behavior of powders. Suitable pressing and sintering results were obtained with prealloyed, calcium-reduced U–Mo powder and with molybdenum and calcium-reduced uranium as elemental powders. Shotted prealloyed powders were difficult to press and sinter, as were elemental and prealloyed powders prepared by hydriding. The cores containing UO_2 were picture-frame, hot-roll-clad as miniature plates. Molybdenum, Fansteel 82, and Zr–3 wt % Al were investigated as cladding materials. While each bonded well to itself, only the molybdenum-clad core, rolled at 1150°C to 10/1 reduction, resulted in dispersions free of ruptures and UO_2 fragmentation and in strong bonding to the core, evaluated by metallography, mechanical peel, and thermal shock tests. The matrix phase was homogeneous, but the UO_2 dispersoid showed stringering characteristic of cores worked by hot rolling. Core densities as high as 99% of theoretical were obtained. (auth)

28532 (SRIA-65) EVALUATION OF ECONOMIC BENEFITS FROM A CONTINUING CIVILIAN NUCLEAR POWER PROGRAM. Ely M. Brandes and Leland H. Towle (Stanford Research Inst., Menlo Park, Calif.). July 1962. Contract AT(04-3)-115. 74p.

Discussions are included of six national goals which would be beneficially affected by a continuation of a Civilian Nuclear Power Program. These goals are: conservation of energy resources; competition with fuel and energy industries; disarmament; the CNPP and foreign competition; competition within the nuclear reactor industry; and control of air pollution. Possible additional benefits are mentioned, such as, contributions toward the advancement of technology in other fields. (B.O.G.)

28533 (SRO-83) HEAVY WATER POWER REACTOR PROGRAM MONTHLY PROGRESS REPORT, MAY 1963. (Savannah River Operations Office, AEC). 12p.

Progress made in the development and operation of heavy water reactors is reported. Information is included on the fabrication and testing of the on-power refueling machine for the Candu Reactor, testing of Candu boiler, creep-rupture testing of SAP, nondestructive testing of fuel cladding, header and feeder piping fluid dynamics, testing of dome-type pressure tube closure seal, zirconium technology, heat transfer at low heat flux, Candu fuel radioactivity monitoring system, capacity of heavy water plants, Euratom coöperative program, operation of HWCTR, and development and operation of Carolinas-Virginia Tube Reactor. (N.W.R.)

28534 THE OECD—DRAGON—PROJECT. C. A. Rennie (United Kingdom Atomic Energy Authority, Winfrith, Dorset, Eng.). At. Strom, 9: 37-9(May 1963). (In German)

The Dragon Reactor Project is discussed. Topics covered include history, budget, legal principles, management, organization, personnel, technical and research and development programs, and dissemination of information. (M.C.G.)

28535 GERMAN ATOMIC POWER STATION PROJECTS. At. Strom, 9: 39-41(May 1963). (In German)

Research and development progress and operational experience at the Kahl Atomic Power Plant, physical and technical problems of the AVR Reactors, development of the multipurpose research reactor for the Karlsruhe Nu-

clear Research Center, and design and development of the Gundremingen nuclear power plant are discussed. (M.C.G.)

28536 STATE OF DEVELOPMENT OF WATER-COOLED REACTORS. M. Muysken. Atoomenergie Haar Toepassingen, 5: 85-90(May 1963). (In Dutch)

After a brief discussion of the present state of development of pressurized water reactors, boiling water reactors, and pressurized tube reactors, the possibilities for the future development of each are then considered. The economic aspects of these reactors are indicated. (tr-auth)

28537 OBSERVATIONS ON APPROACHES AND ORGANIZATIONAL PROBLEMS IN THE TESTING OF THE LATINA POWER PLANT. Mario Campanini. Comit. Nazl. Energia Nucl., Notiziario, 9: No. 5, 30-5(May 1963). (In Italian)

The Latina Nuclear Power Plant is briefly described, and the check-out procedures required before start-up are discussed. (J.S.R.)

28538 WATER-CHEMISTRY PROBLEMS IN WATER-COOLED POWER REACTORS. H. Rabold and W. Schimmel (VEB EPkA, Berlin). Kernenergie, 6: 137-45(Apr. 1963). (In German)

The quality demands on water and its preparation are discussed. Nuclear reactions with neutrons are described. Mechanisms of radiolysis and effects of different variables on them are considered. Nuclear properties of water and water activities in a pressurized-water reactor are listed. (M.C.G.)

28539 AN ACCURATE ANGULAR TRANSMITTER FOR THE LOADING MACHINE OF THE DRAGON REACTOR. A. Bauer (Schoppe and Faeser GmbH, Minden, Ger.). Neue Tech., 5: 241-6(May 1963). (In German)

The charging machine of the OECD high temperature reactor DRAGON requires 5 position indications totally, the error of transmission of which will be $\leqq \pm 0.25\%$. Inductive transmitters were used. Their mode of operation, errors, and testing are explained. The servo-controllers used with the transmitters and their damping are described. (auth)

28540 BANG-BANG CONTROL OF BOILING MODERATOR NUCLEAR REACTORS. Milton Ash (System Development Corp., Santa Monica, Calif.). Nucl. Sci. Eng., 16: 208-12(June 1963).

In order to greatly increase the power density of boiling liquid reactors, more turbulent and effusive boiling of the moderator coolant must ensue. However, this would entail handling very large random reactivity excursions with its attendant dangers. Perhaps, this problem could be circumvented by a novel, hyper-speed control comprised of "rod equivalent" systems of very fast response. This would allow the reactor to approach its stability limit more closely and thereby increase the power density. To realize such systems, this effort is directed toward a different conceptualization of the reactor control problem as opposed to the less than adequate small excursion linearized theory extant. The idea involved in "bang-bang" control is that of ever driving the reactor towards it equilibrium state as rapidly as possible from randomly perturbed states in which it finds itself because of the turbulent moderator. The control problem is formulated in a fashion analogous to the brachistochrone class of problems, but with a stochastic feature due to the random reactivity fluctuations. Using the methods of dynamic programming, a functional equation in the minimum time for the reactor to be driven back to equilibrium is obtained. From this is derived an optimal reactor control policy. A controller computer can then be synthesized which instantaneously senses the perturbed state of the reactor. It then computes the optimal reactivity policy and sends actuating signals to the "rod(s)" system. The responding reactor is then found in its new perturbed state, which is again read, etc. This procedure continually drives the reactor toward the equilibrium state in the sense of minimum time defined above. (auth)

28541 HOW BIG WILL POWER PLANTS GET? Harold L. Davis. Nucleonics, 21: No. 6, 60-3(June 1963).

Advantages of building larger power plants (particularly nuclear plants) are cited, and problems that arise as plant size increases are reviewed. Larger plants are noted to effect a savings in capital cost (nuclear plants, especially); but provision of sufficient reserve power to cover the failure of a huge plant, lack of suitable sites, and technical feasibility place limitations on plant sizes. Nuclear plants can, however, overcome most of the limitations. (D.C.W.)

28542 HOW FAR CAN WE GO WITH PWRs? R. J. Creagan and A. R. Jones (Westinghouse Electric Corp., Pittsburgh). Nucleonics, 21: No. 6, 64-7(June 1963).

Limitations that might be imposed upon the size of PWR power plants by the major plant components, by availability of suitable sites, and by fuel costs are discussed; and it is concluded that the PWR plant will be competitive at least until scarcity of fissionable fuels necessitates use of breeder techniques. (D.C.W.)

28543 HOW FAR CAN WE GO WITH BWRs? W. N. Oberly and G. M. Roy (General Electric Co., San Jose Calif.). Nucleonics, 21: No. 6, 68-71(June 1963).

Analysis of factors affecting the selection of size parameters and power levels for a boiling water reactor (BWR) and of the cost (capital and fuel) of such reactors shows that boiling water reactors can provide the 500 Mwe plants needed in the next decade. No limit on the ability of BWR's to meet future plant size requirements is foreseen. (D.C.W.)

28544 THE FUTURE OF FAST BREEDERS. L. J. Koch (Argonne National Lab., Ill.). Nucleonics, 21: No. 6, 72-5(June 1963).

Advantages and the future necessity of using fast breeder reactors are pointed out, and problems that hamper their development (fuel requirements, control and safety, sodium technology, and fuel handling) are discussed. (D.C.W.)

28545 THE FUTURE OF THERMAL BREEDERS. M. C. Edlund and P. F. Schutt (Babcock and Wilcox Co., Lynchburg, Va.). Nucleonics, 21: No. 6, 76-8(June 1963).

Thermal breeder reactors are noted to require a fuel yield of at least 8% per year if they are to furnish power for the future. Breeder design requirements are given, and the four main breeder concepts are discussed. Of the four, only the aqueous homogeneous reactor offers the 8% fuel yield, and work on this concept has been stopped. Projected fuel costs and performance of some breeders are included. (D.C.W.)

28546 WANTED: A BALANCED NUCLEAR ECONOMY. D. J. Stoker, S. Golan, and S. Siegel (Atomics International, Canoga Park, Calif.). Nucleonics, 21: No. 6, 79-82(June 1963).

Attempts at pricing Pu and U^{233} produced as reactor by-products for use as fuel in other reactors are discussed, and it is noted that in a balanced economy in which by-products are used as fuel for other reactors fuel cycle costs will be reduced as economic and technical factors set Pu and U^{233} values in the free market. (D.C.W.)

28547 ELK RIVER REACTOR. Nucleonics, 21: No. 7, 37-42(July 1963).

The control rods, core structure, fuel elements, and containment and reactor vessels for the Elk River Reactor facility are described. All steam produced in the boiling water reactor is used to heat water in a secondary circuit that passes through a coal-fired superheater to the turbine-generators. This arrangement allows switching the turbine-generators to conventional boilers without contamination risks. Future conversion from natural to forced circulation will permit doubling of reactor power. Heat-transfer, nuclear, and reactor design data are given. (D.C.W.)

28548 MHD POWER CONVERSION. W. E. Gunson, E. E. Smith, T. C. Tsu, and J. H. Wright (Westinghouse Electric Corp., Pittsburgh). Nucleonics, 21: No. 7, 43-7 (July 1963).

Development problems and technical features of magnetohydrodynamic (MHD) generators that could operate with the relatively low temperatures provided by gas-cooled reactors are discussed. Principles of MHD generation are given, and proposed designs for a 500-Mwe power plant and an MHD space power convertor are included. Electron injection and electron-heating ionization are the two forms of necessary nonthermal ionization considered for such devices. (D.C.W.)

28549 DESIGN OF NUCLEAR POWER PLANT WITH SEPARATE SUPERHEATED STEAM REACTORS. S. M. Driven and L. P. Kabanov (Moscow Inst. of Power Engineering). Teploenerg., No. 5, 35-8(May 1963). (In Russian)

A nuclear power plant designed with superheated steam reactors is described. Operation of a nuclear plant with serial turbines, PVK-150 and PVK-200, with intermediate steam superheating in a special heat exchanger, and with identical initial steam parameters without intermediate superheating is discussed. (R.V.J.)

28550 IMPROVEMENTS IN OR RELATING TO NUCLEAR POWER PLANT UTILISING STEAM. Stefan George Bauer and Norman Battle (to Rolls-Royce Ltd.). British Patent 928,484. June 12, 1963. Filed Jan. 2, 1961.

Separation of compartments containing the steam-handling components of a nuclear power plant by a compartment housing a condenser composed of corrugated aluminum plates would prevent excessive pressure buildup if a steam-releasing accident occurred in one of the separated compartments. (D.C.W.)

28551 IMPROVEMENTS RELATING TO NUCLEAR MAGNETOHYDROELECTRIC GENERATORS. (to United Aircraft Corp.). British Patent 928,836. June 19, 1963. Priority date July 22, 1960, United States.

A magnetohydroelectric generator is designed for increased efficiency and power output by means of a fission reaction of a material dispersed in the working fluid. The generator has a duct for passing the fluid therethrough, moderator means surrounding the duct, and electrode means in contact with the fluid in juxtaposed relation with the moderator means. Several embodiments of the generator are described. (D.L.C.)

28552 IMPROVEMENTS IN OR RELATING TO NUCLEAR REACTORS. (to General Dynamics Corp.). British Patent 928,872. June 19, 1963. Priority date Dec. 7, 1960, United States.

An improved high-temperature gas-cooled reactor is designed. The gas coolant is circulated upwardly along the side wall of the pressure vessel, downwardly through the core, and then out of the vessel. The fuel elements are provided with impervious graphite cladding, and a fission product trapping system is provided in the cooling circuit. (D.L.C.)

28553 A BOILING WATER REACTOR. (to Licentia, Patent-Verwaltungs GmbH). British Patent 928,915. June 19, 1963. Priority date June 12, 1959, Germany.

A boiling reactor is designed for increased efficiency of steam–water separation and natural circulation. The reactor comprises a pressure vessel, fuel elements arranged vertically within the vessel, steam delivery pipes arranged coaxially with and above the fuel elements, and means for maintaining the water level above the lower ends of the pipes. Chimneys with centrifugal steam separators may be provided between the fuel elements and the pipes. (D.L.C.)

28554 A THERMIONIC EMISSION CONVERTER FOR THE DIRECT CONVERSION OF THERMAL ENERGY INTO ELECTRICAL ENERGY. (to European Atomic Energy Community). British Patent 928,985. June 19, 1963. Priority date Mar. 13, 1961, Germany.

A thermionic converter is designed for converting nuclear energy into electrical energy. The converter comprises a hot solid emitter electrode in the form of a fuel element, a cold liquid collector electrode, and a gas film between the electrodes, formed by the evaporation of the collector. The collector, which preferably is a fused alkali metal, is circulated in a cooling and purification circuit. (D.L.C.)

28555 A BOILING WATER NUCLEAR REACTOR SYSTEM. (to General Nuclear Engineering Corp.). British Patent 928,995. June 19, 1963. Priority date Dec. 20, 1960, United States.

A boiling reactor system is designed whose core is divided into a number of flow passages, so that the center core region is cooled by forced circulation while the outer region is cooled by natural circulation. Several embodiments of nuclear power plants employing such a reactor are described. (D.L.C.)

28556 IMPROVEMENTS IN NUCLEAR POWER INSTALLATIONS AND IN PRESSURE ENCLOSURES THEREOF. (to Babcock and Wilcox Co.). British Patent 929,784. June 26, 1963. Priority date Sept. 15, 1958, United States.

A pressure enclosure for a nuclear power station is designed for the facilitation of monitoring and maintenance of plant components. The enclosure surrounds the closed coolant path along its length in such a way that its configuration generally follows the shape of the contained components. In the event that a length between joints of the coolant conduit needs replacement, the operation can be carried out remotely, as described in British Patent 929,785. (D.L.C.)

28557 IMPROVEMENTS IN CONDUITS FOR NUCLEAR REACTOR INSTALLATIONS. (to Babcock and Wilcox Co.). British Patent 929,785. June 26, 1963. Priority date Sept. 15, 1958, United States.

A tubular conduit for reactor coolant fluid is designed for use in the pressure enclosure described by British Patent 929,784. The enclosure surrounds the closed coolant path of the reactor, and its configuration follows the shape of the contained components. The conduit is provided with a tubular safety pressure sleeve comprising a plurality of sleeve lengths which are displaceable telescopically in order to yield access to the conduit joints for replacement of conduit lengths. The replacement can be performed remotely. (D.L.C.)

28558 NUCLEAR REACTOR POWER PLANTS. (to Sulzer Freres, Societe Anonyme). British Patent 929,924. June 26, 1963. Priority date Apr. 28, 1961, Switzerland.

A nuclear power plant is designed for improved thermal efficiency along with a relatively simple construction. The

heat exchanger is divided into two parts, with a blower in between, and two vapor generators are provided in the heat exchanger. The reactor is divided into at least two zones of different heat evolution, and the coolant therefrom is fed to different places in the first part of the heat exchanger. (D.L.C.)

28559 NUCLEAR POWER PLANT. George Edward Preece and Francis Robert Bell (to De Havilland Engine Co., Ltd.). British Patent 929,941. June 26, 1963. Filed June 1, 1959.

A protective arrangement is designed for shielding the environment and for preventing the leakage of radioactive gases from a ship nuclear power plant. In this arrangement, the core has inner and outer pressure vessels and a biological shielding around the outer pressure vessel. The shielding comprises a series of steel cylindrical shells immersed in water, and its inner wall may comprise part of the outer pressure vessel. (D.L.C.)

28560 NUCLEAR DEVICE FOR GENERATING ELECTRIC POWER. Francis E. Jablonski and Charles B. Leffert (to General Motors Corp.). U. S. Patent 3,093,567. June 11, 1963. Filed Mar. 30, 1959.

A nuclear power plant in which d-c power is directly generated from the reactor heat by thermoelectric cells composed of one fuel element each is described. The fissile material forms the cathode of a diode that is separated by a fission-fragment-ionized plasma from a cooled conducting surface forming the anode. Power outputs of about 50 watts/cm^2 can be achieved with conversion efficiencies of about 30%. (D.C.W.)

Research Reactors

28561 (APED-5000) LICENSE APPLICATION FOR THE GENERAL ELECTRIC TEST REACTOR. Final Hazards Summary Report. (General Electric Co. Vallecitos Atomic Lab., San Jose, Calif.). [1962]. 321p.

The General Electric Test Reactor and experimental facility designs, operations, and evaluations are described. Topics covered include: reactor core assembly, reactor vessel, control rods and drives, reactor performance, instrumentation, shielding, containment building and arrangement, reactor cooling system, ventilation, utilities, mechanical and operational accidents, maximum credible accident, radiation hazards evaluation, administrative and procedural controls, in-core capsules, pool capsules, miscellaneous capsule experiments, beam port, loop facilities, pressurized-water loop, boiling-water loop, the nitrogen loop, high-temperature helium loop, radioactive wastes, environmental monitoring, and site characteristics. (M.C.G.)

28562 (EUR-185.f,d,e) A STUDY OF THE TRANSPORT OF IRRADIATED RESEARCH REACTOR FUEL. Final Report. (Lebon et Cie., Paris; Société Générale d'Exploitations Industrielles, Paris; Allgemeine Elektrizitatsgesellschaft, Frankfurt am Main; and Edlow Lead Co., Columbus, Ohio). 1963. 114p. (In English, French, and German)

In connection with the preparation by the Commission of an invitation to tender for the transport to a chemical reprocessing plant of fuel elements discharged from the Community's research reactors, three private firms were commissioned to carry out studies with the object of determining the various aspects of these transport operations in the light of current know how in Europe and the United States. The results of these studies are presented in the form of this background file, which consists of three parts representing the respective contributions of the firms commissioned for the studies. (auth)

28563 (EUR-271.i) PRIMO ESAME DI UN REATTORE AD ESCURSIONE DI POTENZA DA IMPIEGARE PER LA RICERCA SULLA SICUREZZA DEI REATTORI NUCLEARI. (Preliminary Inquiry on a Power Excursion Reactor to be Utilized for Research on Nuclear Reactors). V. Coen, G. Dondi, C. Foggi, F. Lanza, S. Ley, R. Richena, W. Riebold, C. Rinaldini, and G. Volta (European Atomic Energy Community. Nuclear Research Center, Ispra, Italy). 1962. 17p.

Possible ways of dealing at Ispra with reactor safety have led to the development of a power excursion reactor, especially suited to perform destructive testing of fuel elements. The performances could be higher than those of the similar Treat reactor. Tests on large fuel elements with low fissile material contents would be possible. (auth)

28564 (KR-46) JEEPNIK—THE KJELLER MINIATURE EXPONENTIAL FACILITY. H. Windsor (Norway. Institutt for Atomenergi, Kjeller). May 1963. 22p.

Jeepnik is a small exponential facility designed for use in measuring intensive reactor physics parameters of lattices investigated in the NORA Project. The permanent part of the facility consists of a water-filled rectangular aluminum tank extending vertically down through the Jeep top shielding to a point above the thermal column. The Jeepnik facility is described along with data on the first cores investigated after it was brought into operation in March 1962. (N.W.R.)

28565 (LAMS-2915) QUARTERLY STATUS REPORT ON LAMPRE PROGRAM FOR PERIOD ENDING MAY 20, 1963. (Los Alamos Scientific Lab., N. Mex.). June 1963. Contract W-7405-eng-36. 17p.

Progress made in the development and operation of LAMPRE I (Core II) is summarized. Information is included on irradiated capsule scanning, heat transfer calculations, and core calculations. Development of the Core Test Facility is reported. Metallographic evaluation of LAMPRE fuel capsules is accomplished by studying fabrication techniques, plutonium–cobalt–cerium fuels, cerium-based alloy fuels, uranium–manganese–plutonium fuels, and capsules of tantalum, tantalum–tungsten alloy, and niobium. Phase studies are made of various plutonium alloy systems. (N.W.R.)

28566 (NP-12915) PRELIMINARY HAZARDS SUMMARY REPORT FOR NUCLEAR RESEARCH CENTER, UNIVERSITY OF CINCINNATI, CINCINNATI, OHIO. Warren F. Stubbins (Cincinnati. Univ.); John F. Luhan (Kinney (A. M.), Inc., Cincinnati); and Charles C. Hoffman (Lockheed Georgia Co., Marietta, Ga.). May 1963. 278p.

The 5 Mw(t) open-pool type research reactor embodies all the essential safety characteristics. The operation of the reactor in accord with its research program will involve no unusual hazards. The reactor building will provide adequate confinement to permit operation at the reactor site. The conservative analysis shows no difficulty from air-borne radioactive effluents from continuous operation at 5 Mw. The control and safety system contains necessary safeguards to prevent inadvertent abnormal operation. The design and characteristics of the reactor are given. (N.W.R.)

28567 (UCRL-7214) DETERMINATION OF MAXIMUM FUEL PLATE TEMPERATURE IN A LIGHT WATER MODERATED RESEARCH REACTOR WITH CENTRAL WATER VOID (thesis). G. A. Broadman (California. Univ., Livermore. Lawrence Radiation Lab.). Feb. 20, 1963. Contract W-7405-eng-48. 111p.

The present operating level of the Livermore Pool Type Reactor is 2 Mw. With the addition of two heat exchangers and a second cooling tower, the power level will be raised to 5 Mw. An experimental study was carried out on the reactor standard core configuration to predict the maximum fuel and cladding temperatures, and their location at the higher power level. This standard core has a central water void that produces a large peaking flux. Consequently, the fuel plates in the central region operate at abnormally high temperatures. The hot spot temperatures were determined from: flux plots using copper and U^{235} wires as activation samples; analytical methods; and γ-ray corrected nickel resistance thermometers. The results of these three methods compared very well. (auth)

28568 HARWELL'S REACTORS. PART II. W. F. Hood (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Atom, No. 80, 183-96(June 1963).

A description is given of the experimental rigs and loops at Harwell. The equipment described includes the DIDO high-pressure water loop, DIDO rabbit network, DIDO liquid H_2 loop, and high-temperature gas-cooled Pluto Loop "A". (D.L.C.)

28569 IMPROVEMENTS IN OR RELATING TO TANKS OR ENCLOSURES FOR NUCLEAR REACTORS OF THE SWIMMING-POOL TYPE. Michel Rivat (to Commissariat a l'Energie Atomique). British Patent 928,622. June 12, 1963. Priority date June 13, 1960, France.

A swimming pool reactor tank comprising a metal container supported within a surrounding concrete enclosure that has projections on its inner face to form compartments between the concrete and metal enclosures offers many advantages. Powdered aggregate filling the compartments gives biological protection and ready access (by its removal) to the metal tank and to conduits and circuits passing through the compartments. (D.C.W.)

28570 IMPROVEMENTS IN OR RELATING TO LOW TEMPERATURE IRRADIATION. Louis Bochirol, Jacques Doulat, and Louis Weil (to Commissariat a l'Energie Atomique). British Patent 929,585. June 26, 1963. Priority date Dec. 15, 1959, France.

A relatively simple and economical apparatus for low-temperature irradiations in a swimming-pool reactor is designed to prevent radiation leaks and at the same time provide ready access to the samples. In the apparatus, continuous circulation of a cryogenic fluid (high-purity N_2) is effected by gravity between a liquid bath in an intense radiation flux and a heat exchanger in a weak flux. Condensation in the exchanger is effected by means of N_2 of commercial purity. (D.L.C.)

28571 NUCLEAR REACTOR AND IRRADIATING SYSTEM. Richard S. Stone and George P. Kraker (to General Dynamics Corp.). U. S. Patent 3,094,470. June 18, 1963. Filed Nov. 12, 1959.

A reactor of the swimming-pool type is designed for producing short-lived radioisotopes. The reactor has a rotary specimen rack and means for moving a specimen in the rack. (D.L.C.)

SPACE APPLICATIONS AND TECHNOLOGY

Refer also to abstract 27506.

28572 (LA-2885) INTEGRAL GAMMA AND NEUTRON MEASUREMENTS ON KIWI B-4A. R. W. Henderson, F. C. V. Worman, F. M. Cox, and P. K. Lee (Los Alamos Scientific Lab., N. Mex.). Mar. 1963. Contract W-7405-eng-36. 57p.

Data are presented on integral neutron fluxes and gamma and neutron rad doses measured on the experimental plans involving criticality of the Kiwi B-4A reactor. Studies included a 1,500-foot freeline, two meridian rings, and an equatorial bar. Neutron fluxes and gamma and neutron rad doses show a good approximation to the inverse square relationship with distance, with air attenuation, along the freeline. The angular distribution of the leakage radiation is highly influenced by the core configuration. The equatorial bar shows the experimentally determined flux in the horizontal plane to be isotropic over the arc of the bar. Gamma-to-fast-neutron-dose ratios varied from ~1 at 62 feet to 1.8 at 900 feet. The ratio of the thermal-to-total-fast-flux varied from 0.6 at 62 feet to 0.4 at 1,500 feet. (auth)

28573 (NAA-SR-8304) PHASE I MECHANICAL AND THERMOCHEMICAL TEST SERIES. SNAP AEROSPACE SAFETY PROGRAM. S. L. Pfahler (Atomics International. Div. of North American Aviation, Inc., Canoga Park, Calif.). June 30, 1963. Contract AT(11-1)-Gen-8. 31p.

A description is given of the test series conducted in conjunction with the SNAP Aerospace Safety Program. The principal objective of the tests was to obtain data and information for evaluating the hazards occurring before, during, and after the flight of the SNAP 10A reactor. The results of these tests will provide a means for developing criteria to guide in the design of inherently safe SNAP systems. (auth)

28574 (PWA-2197) EXPERIMENTAL INVESTIGATION OF HEAT REJECTION PROBLEMS IN NUCLEAR SPACE POWERPLANTS. Third Quarterly Report, December 1, 1962 through February 28, 1963. H. R. Kunz, H. L. Ornstein, S. S. Wyde, Sr., and J. R. Hooper (Pratt and Whitney Aircraft Div., United Aircraft Corp., Hartford, Conn.). Contract NAS3-2335. 168p.

Additional experiments were performed in three areas important to the design of space heat-rejection systems. These are: flow distribution and losses in header-tube configurations for space radiators; stability of header-condenser-tube combinations; and startup and transient operating characteristics of a variety of simulated Rankine cycle space power plants. Tests on fourteen manifolds with single-branch tubes showed that pressure losses increase as fluid quality decreases. The effects of angle of turn, branch size and shape, and liquid phase dispersion on pressure loss and outlet quality were determined and data correlations obtained. Tests were begun on multibranch tubes. The condensing stability rig was completed and checked out, including single-phase flow pressure loss tests in a single tube. During initial tests with two-phase condensing flow, a total pressure rise was measured. Changes were made to the radiator simulator which eliminated the thermal stress problem. The instability problems previously encountered in tests of automatically-sequenced starts were investigated, and methods to avoid these instabilities were successfully demonstrated. (auth)

28575 DUAL ELECTRIC-NUCLEAR ENGINE. Myron Levoy (Thiokol Chemical Corp., Denville, N. J.). AIAA (Am. Inst. Aeron, Astronaut.) J., 1: 1298-1302(June 1963).

The dual electric-nuclear rocket system combines a nuclear rocket for high thrust phases of manned interplanetary space missions with a cluster of electric engines powered by the same reactor for high-specific-impulse, low-thrust phases. For a seven-man fast Mars mission, the dual electric-nuclear engine can reduce the space vehicle gross weight in initial earth orbit to between 40 and 60% of that for an all-nuclear engine. The nuclear reactor is designed to operate in both open-cycle and closed-cycle systems. During open-cycle high-thrust phases, hydrogen propellant is heated as it flows through the reactor core passages and then exhausts through a nozzle to give I_{sp} of about 833 sec. These open-cycle, high-thrust phases are used for orbital escape or orbital capture. In the closed-cycle phases, the reactor, operating at reduced power, heats a circulating fluid that drives a turbogenerator. The generator, in turn, powers a cluster of MHD accelerators, providing low thrust at an I_{sp} of 4900 sec. These low-thrust phases are used for shortening trip times in what otherwise would be the coast periods of the nuclear rocket mission. (auth)

28576 NUCLEAR REACTORS IN SPACE. Bernard I. Spinrad (Argonne National Lab., Ill.). News-Bull. Intern. (Argonne Natl. Lab.), 4: No. 3, 5-10(June 1963).

Advantages of using nuclear reactors in space flight are given, and systems now under development are described. These include heat transfer rockets in which fuel is heated to high temperatures by reactors, electrical propulsion systems (ion and plasma drives) in which the electricity is provided by reactor-driven generators, and electric power generators that convert nuclear power to electric power. Feasibility of the systems is discussed along with problems in their design. (D.C.W.)

28577 THE VOYAGE OF MARINER II. J. N. James. Sci. Am., 209: 70-84(July 1963).

A detailed account is presented of the events leading to the successful rendezvous of Mariner II with Venus on Dec. 14, 1962. The development of the spacecraft is described. The launching and some of the adventures in space, such as the mid-course maneuver, are described. Finally, the rendezvous and some of the measurements are discussed. (D.L.C.)

28578 RADIOACTIVE POWER SUPPLY SYSTEM. Ernest G. Linder (to U. S. Air Force). U. S. Patent 3,093,788. June 11, 1963. Filed Aug. 26, 1955.

A lightweight, simplified system for radioactively generating electrical energy for missiles and rockets is described. The system consists of two electrically conductive bodies of quite unequal sizes connected through the work load, this entire system being enclosed in a vacuum or other non-conductive non-ionizable medium. Emission of charged particles by a radioactive coating on the smaller body results in a potential difference across the load as charged particles flow from the larger body. (D.C.W.)

WASTE DISPOSAL AND PROCESSING

28579 (EURAEC-295) RESEARCH PROGRAM ON THE TREATMENT AND STORAGE OF RADIOACTIVE WASTES. L. Baestlé, P. Dejonghe, R. Lopes Cardozo, W. Maes, E. S. Simpson, and N. Van de Voorde (Société Belge de Chimie Nucléaire, Brussels and Brussels. Centre d'Etude de l'Energie Nucléaire). 1962. Work Performed under Unites States–Euratom Joint Research and Development Program. Contract 010-60-4 RDB. 78p. (EUR-81.e)

Maps of the Mol site were prepared showing contours of the water-table at time intervals of approximately one month. Several techniques were studied to trace the detailed movement of ground water in situ. A promising method involves the injection of a radioiodine source into the zone of saturation and then detecting its subsequent dispersion in the ground water by means of copper rods or silver-plated copper rods, inserted into the ground. The physical-chemical characterization of the Mol site and the clay-ground at Houthulst was started. Studies on multiple component exchange systems were continued. A first attempt was made in order to evaluate the combined saturating capacity of the different horizons of the unsaturated part of the profile. Laboratory studies were performed on conditions of incorporation of ashes and semi-dry sludges in asphalt. Samples were submitted to irradiation at 10^8 rad. The elution rate of irradiated and non-irradiated samples was around 10^{-6} g/cm^2-day. Construction of the incinerator was started. It will consist of a series of three combustion chambers for fines, normal laboratory wastes, and post-combustion of the gases. A laboratory unit was built for continuous removal of iodine from gases; it consists of a tube in which gas and sorbant circulate, the sorbant being recycled. (auth)

28580 (HW-76222) LABORATORY AND HOT-CELL CESIUM-DIPICRYLAMINE SOLVENT EXTRACTION STUDIES. L. A. Bray and F. P. Roberts (General Electric Co. Hanford Atomic Products Operation, Richland Wash.). Jan. 1963. Contract AT(45-1)-1350. 48p.

Studies were made of the dipicrylamine–nitrobenzene system for possible use in cesium extraction from fission product wastes. Synthetic and actual Purex wastes were tested. The extraction of cesium by dipicrylamine appears to obey the ion-pair mechanism and is proportional to the dipicrylamine concentration, the reciprocal of the aqueous sodium content, and a decrease in temperature. The extracted cesium is readily stripped with dilute acid, and the extraction and stripping are rapid. Dipicrylamine is sufficiently radioresistant; it requires 2×10^8 r for its total destruction. The solubilities of nitrobenzene and dipicrylamine in alkaline wastes were found low enough for minimal losses in extraction processes. (D.L.C.)

28581 (HW-77299) RESEARCH AND DEVELOPMENT ACTIVITIES. FIXATION OF RADIOACTIVE RESIDUES. Quarterly Progress Report, January–March 1963. E. R. Irish, ed. (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Apr. 1963. Contract AT(45-1)-1350. 59p.

The radiant-heat spray calciner and pot calciner in the High-Level Radiochemistry Facility were used for additional experimental studies of full-level Purex 1 WW calcination. Two spray calcination runs and three pot calcination runs were made to produce calcined wastes of specific characteristics and to evaluate off-gas decontamination requirements. The large Cold Semi-Works radiant-heat spray calciner was operated with the primary objective of testing draft tubes and their effectiveness in minimizing wall deposits of calcine. Additional data were obtained on reactor capacity, the effects of using steam as an atomizing gas, and the behavior of mercury compounds in the waste solution. Studies of the various parameters which control the behavior of the electrostatic bubble scrubber were undertaken. Development work on the storage of waste slurries included studies on suspension of slurries and removal of settled sludges in tanks. Engineering-scale studies of the packaging of radiocesium and radiostrontium concentrates were continued. Equilibrium constants were determined for 3 binary alkali metal cation systems on 7 zeolites. Irregularities in some isotherms can be accounted for on the basis of crystal stacking faults and ionic size. Two runs were made in the Micro Pilot Plant (MPP) with Purex Tank Farm condensate to evaluate the decontamination ability of thin precoat beds of cation exchangers and their beneficial application to an overall condensate decontamination flowsheet. Additional data were obtained for definition of the flowsheet for cesium recovery from Purex high-level wastes by use of inorganic ion exchangers. Data were obtained on the volatility and elution of cesium and strontium from loaded inorganic ion exchangers heated to 700 and 1000 C. Extensive laboratory and pilot plant development work was performed on the CSREX solvent extraction process for the simultaneous extraction of cesium, strontium and rare earths from Purex 1 WW. The solvent used in this new process is a combination of 0.3 M D2EHPA and 0.5 M BAMBP (di-2-ethylhexyl phosphoric acid and 4-sec-butyl-2-[α methylbenzyl]phenol) in Soltrol diluent. (auth)

28582 (ORNL-3322) LOW-RADIOACTIVITY-LEVEL WASTE TREATMENT. PART I. LABORATORY DEVELOPMENT OF A SCAVENGING-PRECIPITATION ION-EXCHANGE PROCESS FOR DECONTAMINATION OF PROCESS WATER WASTES. Rowland R. Holcomb (Oak Ridge National Lab., Tenn.). July 10, 1963. Contract W-7405-eng-26. 41p.

A scavenging-precipitation ion-exchange process using phenolic resins was developed to decontaminate low-radioactivity-level process water waste prior to discharge to the environment. In laboratory and small engineering-scale tests, greater than 99.9% of the cesium and strontium, the principal biological hazards were removed from ORNL low-level waste, and the total activity level was lowered to less than the maximum permissible concentration recommended for populations in the neighborhood of atomic energy installations. The water was treated by a scavenging-precipitation with sodium hydroxide, pH 11.7, and ferrous sulfate, copperas-5 ppm Fe, to remove suspended solids and soluble hardness, clarified, and then passed through a carboxylic-phenolic ion-exchange resin to sorb the remaining radionuclides. After passage of 1,500 to 2,000 resin-bed volumes, the resin was eluted with 10 volumes of 0.5 M HNO_3. Sodium carbonate can be added in the precipitation step to aid the quantitative precipitation of calcium for wastes that contain small amounts of phosphates, or alternatively, an extra ion-exchange column of carboxylic resin can be used to remove calcium and thus conserve the capacity of the phenolic resin for cesium and strontium. Three kinds of studies were made:

batch laboratory-scale studies, continuous nonradioactive runs at 15 liters/hr, and runs with radioactive waste at 60 liters/hr. These studies led to a pilot-plant demonstration of the process. The process is similar to that reported in ORNL-3036, which describes the use of a sulfonic-phenolic resin and a 5 M HCl regenerant. (auth)

28583 (ORNL-3357) EVALUATION OF ULTIMATE DISPOSAL METHODS FOR LIQUID AND SOLID RADIOACTIVE WASTES. V. EFFECTS OF FISSION PRODUCT REMOVAL ON COSTS OF WASTE MANAGEMENT. J. J. Perona, J. O. Blomeke, R. L. Bradshaw, and J. T. Roberts (Oak Ridge National Lab., Tenn.). June 26, 1963. Contract W-7405-eng-26. 34p.

In a study based on optimistic expectations of waste composition from future fission product separations processes, estimated costs for management of wastes from which 90 and 99% of all fission products were removed were from 70 to 80% of those for management of waste from which no fission products were removed. This cost difference is not believed to be sufficient to pay for the separation and final disposal of the fission products, which was not included in the waste management costs; hence, separation does not represent an economic route for waste management unless a substantial market for the fission products exists to pay most of the costs. As a basis for this study, it was assumed that after fission product removal the waste was identical to neutralized Purex waste in volume and composition of major ingredients. The sequential steps in the management of waste from processing 1500 metric tons per year of uranium converter fuel irradiated to 10,000 Mwd/ton were: interim storage of liquid waste, conversion to solids by pot calcination, interim storage of calcined solid waste, shipment of 1000 miles, and final disposal in a salt mine. Minimum-cost schemes were worked out involving optimum choices of interim liquid and solid storage times, diameter of the waste-calcination cylinder, and age at time of burial in the salt. Costs for wastes from which fission products were removed were least for calcination in 24-in.-dia. vessels, were not strongly affected by age, and fell in the range of 0.017 to 0.019 mill/kwh(e). The lowest cost for acid Purex waste without fission product removal was about 0.024 mill/kwh(e), obtained by using either 12- or 24-in.-dia. calcination vessels and buried in salt after allowing 30 years for decay of the fission products in the calcined wastes. These costs are equivalent to about $1600 per ton of fuel for acidic Purex, and about $1100 to $1200 per ton for the depleted wastes. (auth)

28584 (RAI-113) FOAM SEPARATION. Quarterly Progress Report, January 1 to March 31, 1963. Eliezer Rubin and Ernest Schonfeld (Radiation Applications Inc., Long Island City, N. Y.). June 12, 1963. For Oak Ridge National Lab., Tenn.). Contract W-7405-eng-26; Subcontract 2024. 14p.

Additional experimentation with the combined phosphate–iron coagulation and foam separation process has indicated that: A 7-minute residence time in the mixing beaker prior to foaming results in lower Sr^{2+} DF's than residence times of 17–23 minutes. Higher DBS concentration may be required for treating actual ORNL-LAW than for simulated LAW. Intermittent addition of grundite clay into the mixing beaker, in addition to $PO_4^{\equiv}$, Fe^{2+}, Armeen Z, and DBS, prior to foaming produced only very low decontamination factors for Cs^{+}. The use of split surfactant feed has produced average Sr^{2+} DF's of up to 580 with actual ORNL LAW solutions as feed. Experiments with the NaOH + Na_2CO_3 pretreatment followed by foam separation resulted in overall Sr^{2+} DF's in excess of 15,000 when simulated LAW was used as feed. Sr^{2+} DF's of up to 275 were obtained under similar conditions with actual LAW. Studies on the effectiveness of various commercially available gas distributors were initiated. (auth)

28585 RADIANT-HEAT, SPRAY-CALCINATION PROCESS FOR SOLIDIFICATION OF RADIOACTIVE WASTE. Rudolph T. Allemann and Benjamin M. Johnson (General Electric Corp., Richland, Wash.). Ind. Eng. Chem., Process Design Develop., 2: 232-8(July 1963).

The application of the radiant-heat spray calciner to the continuous calcination of simulated radioactive waste was studied to develop more reliable methods of high-level waste storage. The experimental equipment is described, and the effects of various operating variables on factors such as capacity and completeness of calcination are discussed. The process has several characteristics which make it attractive for waste calcination: operation is insensitive to changes in waste composition and is readily adaptable to many different types of feed. The simplicity of equipment and operation indicates a remote installation should not be difficult to run and maintain. (auth)

28586 IMPROVEMENTS IN AND RELATING TO THE DISPOSAL OF RADIOACTIVE WASTE. Rudolf Alberti. British Patent 929,863. June 26, 1963. Priority date Jan. 19, 1959, Germany.

A method is described in which a powdered hydraulically setting absorption material, which may contain a granular, water-insoluble, and chemically inert material, is used for the consolidation of waste solutions to permit their removal and storage without danger of leakage. A funnel-type tube, with apertures along the sides and with its open end near the bottom of the absorbent-filled chamber, is provided to introduce the waste solutions. Introduction of the solution in this way, from the bottom to the top, permits: mixing without stirring; addition of batches at daily intervals without affecting the rapid and smooth absorption of the mixture, as long as the capacity of the absorption vessel is not exceeded; and the formation of a solid without voids or impermeable zones, which may prevent uniform saturation. (B.O.G.)

28587 METHOD FOR DISPOSING OF RADIOACTIVE WASTE AND RESULTANT PRODUCT. Franck C. Arrance (to Coors Porcelain Co.). U. S. Patent 3,093,593. June 11, 1963. Filed July 14, 1958.

A disposal method for radioactive wastes that permits use of the resultant product for air heating and sterilization is described. Radioactive liquid wastes are absorbed by highly porous and absorptive ceramic materials composed of Georgia kaolin, bentonite, feldspar, talc, and whiting (the % composition depends on the waste composition); subsequent heating and glazing seal the ceramic forms that may be of various shapes for the uses mentioned above. (D.C.W.)

CORPORATE AUTHOR INDEX

This index contains entries for all report literature and, in addition, for certain published literature items for which it is felt that a corporate approach is especially desirable, e.g., symposia, conference proceedings, and meetings.

Each entry under a corporate author is a shortened version of the title of the publication, followed by the *NSA* volume and abstract number. Report numbers are given in parentheses.

The phrase "Progress report" is abbreviated as "Prog. rpt." This change permits a more rapid and complete alphabetical arrangement of the titles without changing the location of the progress report titles in relation to the other titles.

A

ADVANCED TECHNOLOGY LABS. DIV. OF AMERICAN-STANDARD, MOUNTAIN VIEW, CALIF.

Prog. rpt. on thermal-stress-fatigue of stainless steels, 1–3/63, 17: 27775 (ATL-A-135)

AEROJET-GENERAL NUCLEONICS, SAN RAMON, CALIF.

Prog. rpt. on Army Gas-Cooled Reactor, 1–3/63, 17: 28528 (IDO-28607)

Prog. rpt. on hydrazine process, 2–4/63, 17: 27414 (ASD-TR-7-840A(IX))

AERONAUTICAL RESEARCH ASSOCIATES OF PRINCETON, INC., PRINCETON, N. J.

Dynamics of gases and plasmas, 17: 27539 (NP-12767(p.10-12))

AERONAUTICAL SYSTEMS DIV., WRIGHT-PATTERSON AFB, OHIO.

Metal alkoxides as coatings for graphite, 17: 27727 (ASD-TDR-63-322)

AERONAUTICAL SYSTEMS DIV. PHYSICS LAB., WRIGHT-PATTERSON AFB, OHIO.

Proton hazard in space, 17: 27596 (NP-12905)

AKTIEBOLAGET ATOMENERGI, STOCKHOLM.

Convective heat transfer from horizontal cylinder rotating in pool of water, 17: 27533 (AE-107)

Selective neutron detector in kev region, 17: 28237 (AE-102)

Two-group analysis of Xe stability in slab geometry, 17: 28416 (AE-108)

AKTIEBOLAGET ATOMENERGI, STUDSVIK, SWEDEN.

Void fractions for flow of boiling D_2O, 17: 27532 (AE-106)

ALLGEMEINE ELEKTRIZITÄTSGESELLSCHAFT, FRANKFURT AM MAIN.

Transport of irradiated reactor fuel, 17: 28562 (EUR-185.f,d,e)

ALLIS-CHALMERS MFG. CO., MILWAUKEE.

Extrusion fabrication of recycled thoria–urania, 17: 28471 (TID-7650(p.553-84))

Pathfinder atomic power plant, 17: 28521 (ACNP-6112(Rev.1))

Pathfinder superheated steam heat transfer, 17: 28522 (ACNP-62030)

AMERICAN NUCLEAR SOCIETY, OAK RIDGE, TENN.

Thorium Fuel Cycle Symposium, Gatlinburg, Tenn., 12/62, 17: 28447 (TID-7650)

AMES LAB., AMES, IOWA.

Scandium–Y and Sc–Zr system, 17: 27785 (IS-569)

Separation of impurities from Th, 17: 28465 (TID-7650(p.436-53))

ARGONNE NATIONAL LAB., ILL.

Code (1559/RE) to compute resonance integrals in mixtures, 17: 28219 (ANL-6709)

Equilibrium shapes of rotating charged drop and consequences for heavy-ion-induced nuclear reactions, 17: 28258 (UCRL-10775)

Ferromagnetism in V–Fe and Cr–Fe alloys, 17: 27801 (TID-17141)

Formation and annealing of radicals in irradiated nitrates. III., 17: 27422 (TID-17105)

FORTRAN programs for computing angular distributions, 17: 28239 (ANL-6718)

Metallurgical studies of Th–U–Pu alloys, 17: 28470 (TID-7650 (p.543-52))

Mössbauer cross section for Fe-57, 17: 28248 (TID-18899)

Phase diagram Ca–Zn, 17: 27800 (TID-17136)

Radiation effects on Th and Th–U alloys, 17: 27887 (ANL-5674)

Thermodynamic properties of V–Fe alloy system, 17: 27774 (ANL-6657)

Thermodynamic study of Th–O system, 17: 27799 (TID-17092)

ARMY MEDICAL RESEARCH AND NUTRITION LAB., DENVER.

Protective shelters, 17: 27598 (NRL-5882)

ATOMIC ENERGY OF CANADA LTD. CHALK RIVER NUCLEAR LABS., CHALK RIVER, ONT.

Radiostrontium, radiocesium and total β activities in Ottawa River water, 17: 27585 (AECL-1765)

ATOMIC POWER DEVELOPMENT ASSOCIATES, INC., DETROIT.

Tests on models of nuclear reactor elements. I., 17: 28445 (NP-12925)

ATOMICS INTERNATIONAL. DIV. OF NORTH AMERICAN AVIATION, INC., CANOGA PARK, CALIF.

ANNEX-1—program for shielding experiments, 17: 28223 (NAA-SR-Memo-8427)

Determination of C in Na, 17: 27317 (NAA-SR-7918)

Electrical conductivities of molten Bi–BiI$_3$ solutions, 17: 27318 (NAA-SR-8086)

Electron irradiation of ordered Cu_3Au, 17: 27892 (NAA-SR-Memo-504)

Epithermal Th reactor physics, 17: 28453 (TID-7650(p.88-127))

Epithermal Th reactors, 17: 28455 (TID-7650(p.148-71))

Evaluation of condensed polycyclic coolant, 17: 27404 (NAA-SR-Memo-7426)

Experiments with Zr hydride critical assemblies, 17: 28481 (TID-18880)

Hydraulic studies of proposed 9-rod SRE 3rd core fuel element, 17: 28443 (NAA-SR-Memo-8406)

Identification of real and spurious scrams, 17: 28442 (NAA-SR-Memo-6688)

Liquid metal flowmeter, 17: 27655 (NAA-SR-Memo-6117)

Phase I SNAP aerospace safety program, 17: 28573 (NAA-SR-8304)

Pre-irradiation metallography on NAA 47 fuels, 17: 27790 (NAA-SR-Memo-8408)

Thorium–UC fuel, 17: 28468 (TID-7650(p.498-518))

B

BABCOCK AND WILCOX CO., LYNCHBURG, VA.

Critical experiments and theory for Th–H_2O lattices, 17: 28452 (TID-7650(p.76-87))

Fabrication of sol-gel thoria–urania, 17: 28473 (TID-7650(p.606-13))

Irradiation testing of thoria–urania fuel, 17: 28475 (TID-7650(p.630-42))

Thermal activation method for ρ_{28} measurements in enriched UO_2 lattices, 17: 28419 (BAW-1268)

Thorium fuel cycle economics, 17: 28479 (TID-7650(p.721-37))

Water-cooled Th reactors, 17: 28456 (TID-7650(p.172-93))

BALDWIN-LIMA-HAMILTON CORP., PHILADELPHIA.

EGCR strain measurements and analyses, 17: 28482 (TID-18888)

BATTELLE MEMORIAL INST., COLUMBUS, OHIO.
Engineering properties of Th–U compounds, 17: 28466 (TID-7650 (p.454-67))
Fission-fragment-induced stresses in ceramic materials, 17: 27888 (BMI-1635)
Prog. rpt. on civilian applications, 4/63, 17: 26944 (BMI-1630(Del.))
Specific heat and heat of fusion of K, 17: 27792 (NP-12933)
Thorium–U and Th–U base alloys for breeder applications, 17: 28467 (TID-7650(p.468-97))
BATTELLE MEMORIAL INST. DEFENSE METALS INFORMATION CENTER, COLUMBUS, OHIO.
Binary and ternary phase diagrams of Nb, Mo, Ta, and W, 17: 27778 (DMIC-183)
BROOKHAVEN NATIONAL LAB., UPTON, N. Y.
Angular distributions in neutron-induced reactions, Z = 1 to 22 and Z = 23 to 94, 17: 28240 (BNL-400(Vols.I and II))
Axial mixing and mass transfer in fused salt–liquid metal extraction columns, 17: 27492 (BNL-791)
Focusing of secondary beams from AGS, 17: 28347 (BNL-7120)
High-temperature liquid-metal technology, Vol. 1, No. 2, 17: 27535 (BNL-801)
Interpretation of scattering from liquid-like binary, 17: 28137 (BNL-6364)
Phase dependence of C-11 recoil products in propane, 17: 27415 (BNL-6354)
Resistivity of vacancy impurity pairs, 17: 27776 (BNL-6358)
Statistical properties of spectra, 17: 27938 (BNL-6396)
Theory of final state interactions, 17: 28136 (BNL-6363)
BRUSSELS. CENTRE D'ETUDE DE L'ENERGIE NUCLEAIRE.
Treatment and storage of radioactive wastes, 17: 28579 (EURAEC-295)
BUREAU OF MINES, BERKELEY, CALIF.
Heat contents and entropies of Lu, Dy, and Ce, 17: 27314 (BM-RI-6248)
BUREAU OF YARDS AND DOCKS.
Protective shelters, 17: 27598 (NRL-5882)

C

CALIFORNIA INST. OF TECH., PASADENA.
Defects in Al quenched from liquid state, 17: 27806 (TID-18876)
Discharge in operating electron bombardment engine, 17: 28360 (JPL-TR-32-417)
Flux to dose rate conversion factors for γ exposure, 17: 27593 (JPL-TR-32-439)
CALIFORNIA RESEARCH CORP., SAN FRANCISCO.
Prog. rpt. on radiolysis of organic fluids, annual, 10/61–9/62, 17: 27423 (TID-18195)
CALIFORNIA. UNIV., BERKELEY.
Half life of F-18, 17: 28250 (UCRL-10512)
Precision-encoded memory (PEM), 17: 26949 (TID-18887)
CALIFORNIA. UNIV., BERKELEY. LAWRENCE RADIATION LAB.
Absolute intensity of C_3 swan bands, 17: 27324 (UCRL-10620)
Anisotropy factors for total neutron yield from D(d,n)He^3 and T(d,n)He^4, 17: 28254 (UCRL-10752(Suppl.))
Charge distributions of products of reactions between complex nuclei, 17: 28253 (UCRL-10741)
Crystalline luminescence of cell-nuclear chemicals under radiation, 17: 27065 (UCRL-10724)
D-c transformer with low noise and wide frequency response, 17: 27658 (UCRL-10473)
Diffusion from line source in magnetic field, 17: 28365 (UCRL-10801)
Emission of charged particles in heavy ion interactions, 17: 28252 (UCRL-10693)
Equilibrium shapes of rotating charged drop and consequences for heavy-ion-induced nuclear reactions, 17: 28258 (UCRL-10775)
Excitation and Lorentz ionization of 10-Mev hydrogen atoms, 17: 27950 (UCRL-10802)
Half life of F-18, 17: 28250 (UCRL-10512)
Impact of dislocation theory on engineering, 17: 27810 (UCRL-10788)
Inelastic scattering of 166-Mev O-16 ions by Ta-181, 17: 28259 (UCRL-10825)
Longitudinal dispersion in packed extraction columns, 17: 27544 (UCRL-10696)
Metastable states in Tl isotopes produced in heavy-ion reactions, 17: 28255 (UCRL-10764)
Neutron spectra from heavy-ion bombardment of Au, 17: 28251 (UCRL-10689)
Phase-shift analysis of heavy ion scattering, 17: 27949 (UCRL-10769)
π^+-p scattering at 600 Mev, 17: 28156 (UCRL-10563)
Polarization and differential cross sections in p-p and p-nucleus scatterings, 17: 28157 (UCRL-10637)
Precision-encoded memory (PEM), 17: 26949 (TID-18887)
Properties of ω meson from $K^- + p \rightarrow \Lambda + \omega$, 17: 28159 (UCRL-10723)
Reaction $\pi^- + p \rightarrow \pi^- + \pi^+ + n$ below 800 Mev, 17: 28158 (UCRL-10720)
Ternary fission of heavy compound nuclei, 17: 28257 (UCRL-10772)
Total reaction cross sections for heavy ions, 17: 28256 (UCRL-10766)
What is the nucleon?, 17: 28160 (UCRL-10842)
CALIFORNIA. UNIV., LIVERMORE. LAWRENCE RADIATION LAB.
Application of Debye model to neutron scattering, 17: 28226 (UCRL-7267)
Bibliography on transition metal refractory carbides, 17: 27809 (UCRL-7284)
Comparison standards for solution calorimetry, 17: 27323 (UCRL-7325-T)
Heat formation of XeF_4, 17: 27321 (UCRL-7298-T)
Heating mechanism for plasma, 17: 28364 (UCRL-7294)
Heats of explosion of unstable gaseous hydrides, 17: 27322 (UCRL-7301-T)
Maximum bound principal quantum number, 17: 28363 (UCRL-6981-T (Rev.I))
Maximum fuel plate temperature in light water moderated research reactor, 17: 28567 (UCRL-7214)
Structures of Ba_2Pb_3, BaPb, and $BaPb_3$, 17: 27808 (UCRL-7030)
Suppressing photomultiplier noise, 17: 27657 (UCRL-6886(Rev.I))
CALIFORNIA. UNIV., LOS ANGELES.
Covalency effects in spectra of Pr^{3+} and Nd^{3+} in $LaCl_3$ and $LaBr_3$, 17: 27311 (AROD-2099.12)
Gamma-emitting radionuclides in newborns, infants and children, 17: 27013 (TID-18878)
Lattice vibration spectra of $LaCl_3$ and $LaBr_3$, 17: 27312 (AROD-2099.13)
Uptake of radioactive material from reactor by mammals at NTS, 17: 27054 (TID-18864)
CAMBRIDGE UNIV., ENGLAND.
What is the nucleon?, 17: 28160 (UCRL-10842)
CANADIAN WESTINGHOUSE CO., LTD., HAMILTON, ONT.
Prog. rpt. on Be research, annual, 1962, 17: 27777 (CW-R&DL-31)
CARNEGIE INST. OF TECH., PITTSBURGH.
Prog. rpt. on nuclear chemistry, 1962–1963, 17: 28247 (TID-18788)
CAROLINAS VIRGINIA NUCLEAR POWER ASSOCIATES, INC., CHARLOTTE, N. C.
Prog. rpt. on CVTR project, 1–3/63, 17: 28523 (CVNA-181)
CENTRAL UTILITIES ATOMIC POWER ASSOCIATES.
Pathfinder superheated steam heat transfer, 17: 28522 (ACNP-62030)
CHICAGO. UNIV.
Crystal structure of alpha Pu metal, 17: 27787 (LADC-5523)
Monoclinic powder x-ray-diffraction patterns of Pu, 17: 27786 (LADC-5522)
CHICAGO. UNIV. LABS. FOR APPLIED SCIENCE.
Symposium on background radiation, 17: 27563 (NP-12932)
CINCINNATI. UNIV.
Hazards rpt. on University of Cincinnati Nuclear Research Center, 17: 28566 (NP-12915)
Medical aspects of radiation accidents, 17: 27632
COLORADO. UNIV., BOULDER.
Colutron, zero deflection isotope separator, 17: 27714 (UCOL-P-516)
Level structure of Sc-44, 17: 28249 (UCOL-P-518)
COLUMBIA UNIV., IRVINGTON-ON-HUDSON, N. Y. NEVIS LABS.
Interaction of high-energy neutrinos with matter, 17: 28151 (NEVIS-111)
Proof of existence of two neutrinos, 17: 28152 (NEVIS-113)
COMPAGNIE GÉNÉRALE DE TÉLÉGRAPHIE SANS FIL, PARIS.
Uranium oxide sintering with view to increasing thermal conductivity, 17: 27814 (EURAEC-103)
COMPAGNIE INDUSTRIELLE DES COMBUSTIBLES ATOMIQUES FRITTES, CORBEVILLE, PAR ORSAY (SEINE-ET-OISE), FRANCE.
Prog. rpt. on UO_2 extrusion, final, 3/63, 17: 27762 (EURAEC-368)
Uranium oxide sintering with view to increasing thermal conductivity, 17: 27814 (EURAEC-103)

CRUCIBLE STEEL CO. OF AMERICA, PITTSBURGH.
Prog. rpt. on refractory alloys, 4/15/61–11/15/62, 17: 27812 (WADD-TR-61-134(Pt.II))

D

DARTMOUTH COLL., HANOVER, N. H.
Prog. rpt. on two-phase flow and boiling heat transfer, 4/63, 17: 27543 (NYO-10486)
DENVER. UNIV. DENVER RESEARCH INST.
Prog. rpt. on determination of Nb-rich region of ternary phase diagrams, 17: 27779 (DRI-2102)
Prog. rpt. on oxidation of beryllides, 6/12/63, 17: 27781 (DRI-2105)
Prog. rpt. on Ti-modified $NbAl_3$, 3–5/63, 17: 27780 (DRI-2104)
DIVISION OF OPERATIONS ANALYSIS AND FORECASTING, AEC.
Calculating U-235 outputs and charges, 17: 27713 (TID-8539)
DIVISION OF RAW MATERIALS, AEC.
Economic mineralogy and geology of Th, 17: 28449 (TID-7650(p.19-28))
DIVISION OF TECHNICAL INFORMATION, AEC.
Objectives of U. S. Th fuel cycle programs, 17: 28448 (TID-7650 (p.1-18))
DIVISION OF TECHNICAL INFORMATION EXTENSION, AEC.
Bibliographies of atomic energy literature, 17: 26948 (TID-3717)
DOUGLAS AIRCRAFT CO., INC., SANTA MONICA, CALIF.
Liquid metal breeder reactor, 17: 28458 (TID-7650(p.210-43))
DU PONT DE NEMOURS (E. I.) & CO., WILMINGTON, DEL.
Prog. rpt. on study of Zr-2 corrosion film, 1–3/63, 17: 27746 (DPST-63-71-1)
DU PONT DE NEMOURS (E. I.) & CO. ATOMIC ENERGY DIV., WILMINGTON, DEL.
Prog. rpt. on heavy water power reactors, 3–4/63, 17: 28526 (DP-845)
DU PONT DE NEMOURS (E. I.) & CO. SAVANNAH RIVER LAB., AIKEN, S. C.
Average growth indices in U tubes containing texture gradients, 17: 27803 (TID-18815)
Buckling and void effects in D_2O moderated, organic, or H_2O cooled lattices, 17: 28483 (TID-18895)
Prog. rpt. on effect of rod spacing on heat transfer burnout, 12/62–2/63, 17: 28422 (DPST-63-69-3)
Prog. rpt. on effect of rod spacing on heat transfer burnout, 3–5/63, 17: 28423 (DPST-63-69-6)
DU PONT DE NEMOURS (E. I.) & CO. SAVANNAH RIVER PLANT, AIKEN, S. C.
Thorium irradiation in D_2O-moderated reactors, 17: 28474 (TID-7650 (p.614-29))
DUQUESNE LIGHT CO., SHIPPINGPORT, PENNA.
Data logging and computing system simulated operating test, 17: 28524 (DLCS-4000201(Rev.))
Prog. rpt. on PWR operations, 4/63, 17: 28525 (DLCS-5000463)

E

EDGERTON, GERMESHAUSEN AND GRIER, INC., SANTA BARBARA, CALIF.
Fort McClellan radiological instruction area (ARMS-II), 17: 26945 (CEX-62.6.2)
EDLOW LEAD CO., COLUMBUS, OHIO.
Transport of irradiated reactor fuel, 17: 28562 (EUR-185.f,d,e)
ELCON LAB., INC., WATERTOWN, MASS.
Prog. rpt. on fast wave plasma amplifier, 2/20/63, 17: 27650 (AD-297382)
Prog. rpt. on fast wave plasma amplifier, 11/20/62, 17: 28357 (AD-290086)
ENGINEERING-SCIENCE, INC., ARCADIA, CALIF.
Recovery and restoration of water works following nuclear attack, 17: 27595 (NP-12902)
EUROPEAN ATOMIC ENERGY COMMUNITY.
Activities of EURATOM dosimetry working group, 17: 27590 (EUR-88.f)
Detection of penetration of fast neutrons in water, 17: 28221 (EUR-107.f)
Determination of impurities in SAP, 17: 27226 (EUR-21.f)
Determination of Fe, Ni and Cr traces in polyphenyls, 17: 27227 (EUR-28.f)
Determination of Ba, Nb, Sr, Fe, Mn and Zn in carbonatites, 17: 27228 (EUR-32.f)
DIFF—7090 FORTRAN program to determine neutron diffusion constants, 17: 28220 (EUR-106.f)
ECO—critical experiment for study of ORGEL lattice, 17: 28427 (EUR-130.f)
FRITTOXAL technology, nuclear applications, 17: 27757 (EUR-273.f)
Gamma radiation curves for steel, Al, and U, 17: 27889 (EUR-103.f)
Instrumentation for health physics' measurements, 17: 27682 (EUR-14.i)
Measurements of ambient radioactivity—Ispra 1961, 17: 27591 (EUR-223.i)
Nondestructive analysis of fuel elements containing U-235, 17: 27229 (EUR-248.f)
Nuclear explosions applied to excavations and earthworks, 17: 27504 (EUR-7.f)
Power excursion reactor, 17: 28563 (EUR-271.i)
Radioactivation analysis in biology, 17: 26963 (EUR-128.i)
Reactivity for different types of fuel cycles, 17: 28426 (EUR-129.f)
Shielding investigations at Ispra, 17: 28407 (EUR-142.d)
Shielding of ORGEL critical experiment, 17: 28428 (EUR-149.f)
Steam cycles for ORGEL power plant, 17: 28424 (EUR-83.f)
Thermal applications of nuclear explosions, 17: 27505 (EUR-16.f)
Transport of irradiated reactor fuel, 17: 28562 (EUR-185.f,d,e)
Xenon effect on reactivity, 17: 28425 (EUR-102.f)
EUROPEAN ATOMIC ENERGY COMMUNITY. NUCLEAR RESEARCH CENTER, ISPRA, ITALY.
Detection of penetration of fast neutrons in water, 17: 28221 (EUR-107.f)
Determination of impurities in SAP, 17: 27226 (EUR-21.f)
Determination of Fe, Ni and Cr traces in polyphenyls, 17: 27227 (EUR-28.f)
Determination of Ba, Nb, Sr, Fe, Mn and Zn in carbonatites, 17: 27228 (EUR-32.f)
DIFF—7090 FORTRAN program to determine neutron diffusion constants, 17: 28220 (EUR-106.f)
ECO—critical experiment for study of ORGEL lattice, 17: 28427 (EUR-130.f)
Gamma radiation curves for steel, Al, and U, 17: 27889 (EUR-103.f)
Instrumentation for health physics' measurements, 17: 27682 (EUR-14.i)
Measurements of ambient radioactivity—Ispra 1961, 17: 27591 (EUR-223.i)
Nondestructive analysis of fuel elements containing U-235, 17: 27229 (EUR-248.f)
Power excursion reactor, 17: 28563 (EUR-271.i)
Radioactivation analysis in biology, 17: 26963 (EUR-128.i)
Reactivity for different types of fuel cycles, 17: 28426 (EUR-129.f)
Shielding investigations at Ispra, 17: 28407 (EUR-142.d)
Shielding of ORGEL critical experiment, 17: 28428 (EUR-149.f)
Xenon effect on reactivity, 17: 28425 (EUR-102.f)
EUROPEAN ORGANIZATION FOR NUCLEAR RESEARCH, GENEVA.
Ionization chamber for estimation of biological effectiveness of radiation, 17: 27056 (CERN-63-17)

F

FRANCE. COMMISSARIAT À L'ÉNERGIE ATOMIQUE. CENTRE D'ÉTUDES NUCLÉAIRES, SACLAY.
Activities of EURATOM dosimetry working group, 17: 27590 (EUR-88.f)
Analysis of traces of C in Na, 17: 27244 (AEC-tr-5839)
Bibliography on isotopes, radiations, agriculture, No. 4, 17: 27635 (NP-12928)
Bibliography on isotopes, radiation, agriculture, No. 1, 17: 27636 (NP-12929)
Highly negative reactivity measurement, 17: 28444 (NP-12910)
FRANKLIN INST., PHILADELPHIA.
Prog. rpt. on gas-lubricated bearings, 12/62–2/63, 17: 27510 (TID-18924)

G

GENERAL ATOMIC DIV., GENERAL DYNAMICS CORP., SAN DIEGO, CALIF.
Fission-product release from UC_2 particles, 17: 27784 (GA-4267)

Physics of the fueled, high-temperature GCR, 17: 28454 (TID-7650 (p.128-47))
Pore structure of graphite as affected by impregnation processes, 17: 27782 (GA-3194)
Prog. rpt. on mechanical properties of reactor materials, 1–3/63, 17: 27783 (GA-4227)

GENERAL DYNAMICS/ASTRONAUTICS, SAN DIEGO, CALIF.
Coaxial gun for plasma propulsion, 17: 28362 (NP-12935)

GENERAL ELECTRIC CO. AIRCRAFT NUCLEAR PROPULSION DEPT., CINCINNATI.
Splitting as function of energy, photoneutron production and variance calculation in MONSTER, 17: 28246 (NDA-Memo-2123-1)

GENERAL ELECTRIC CO. ATOMIC POWER EQUIPMENT DEPT., SAN JOSE, CALIF.
Performance of Core II, NS *Savannah*, 17: 28527 (GEAP-3828)
Prediction of critical heat flux in forced convection flow, 17: 27536 (GEAP-3961)
Prog. rpt. on high-performance UO_2 program, 4–6/62, 17: 28429 (GEAP-3771-5)

GENERAL ELECTRIC CO. HANFORD ATOMIC PRODUCTS OPERATION, RICHLAND, WASH.
Casting of Al–Pu fuel elements, 17: 27758 (HW-69204)
Cesium-dipicrylamine solvent extraction studies, 17: 28580 (HW-76222)
Computer programs for indexing x-ray diffraction powder patterns. I., 17: 27720 (HW-SA-2756)
Cosmic neutron measurements, 17: 28118 (HW-SA-2870)
Erosion-corrosion of Al alloys, 17: 27747 (HW-74359(Rev.))
Fission gas yield in U, 17: 27416 (HW-73394)
In-cell β-γ monitor instruction manual, 17: 27684 (HW-67376)
Irradiation of defected UO_2 swaged rod, 17: 27890 (HW-62762)
Monitoring surface temperature of irradiated fuel elements, 17: 27652 (HW-SA-3036)
Neutron irradiation and cold work effects on Zy-2, 17: 27729 (HW-76636)
Nuclear reactor fuel quality, 17: 28432 (HW-SA-3045)
Performance of miniature glass dosimeters, 17: 27683 (HW-66728)
Prog. rpt. on fixation of radioactive residues, 1–3/63, 17: 28581 (HW-77299)
Prog. rpt. on metallurgy research, 1–3/63, 17: 27730 (HW-77052)
Radiation shielding program, 17: 28408 (HW-SA-3032)
Radioecological studies of northern Alaska, 17: 27053 (HW-SA-3050)
Radioiodine sampling, 17: 27417 (HW-77126)

GENERAL ELECTRIC CO. RESEARCH LAB., SCHENECTADY, N. Y.
Ternary fission of heavy compound nuclei, 17: 28257 (UCRL-10772)

GENERAL ELECTRIC CO. VALLECITOS ATOMIC LAB., PLEASANTON, CALIF.
Liquid metal studies in France and Great Britain, 17: 27731 (NASA-TM-X-884)
Prog. rpt. on Pu recycle for water moderated reactors, 1–3/63, 17: 28431 (GEAP-4216)

GENERAL ELECTRIC CO. VALLECITOS ATOMIC LAB., SAN JOSE, CALIF.
Fission gas pressure in operating fuel elements, 17: 27651 (GEAP-4135)
Hazards rpt. on GETR, 17: 28561 (APED-5000)
Prog. rpt. on Zr alloy design, 7–9/62, 17: 27728 (GEAP-4076)
Superheat strain-cycle capsule, 17: 28430 (GEAP-3933)

GEORGIA INST. OF TECH., ATLANTA. ENGINEERING EXPERIMENT STATION.
Prog. rpt. on materials for high-temperature nuclear application, 1–4/63, 17: 27807 (TID-18891)

GT. BRIT. NATIONAL INST. FOR RESEARCH IN NUCLEAR SCIENCE. RUTHERFORD HIGH ENERGY LAB., CHILTON, BERKS, ENGLAND.
Geometrical reconstruction of bubble chamber tracks, 17: 27686 (NIRL/R/14)
Measuring apparatus used during design of Nimrod magnet, 17: 28349 (NIRL/R/4)
Superconducting coil protection, 17: 27942 (NIRL/R/32)
Toroidal transformers and pre-amplifiers for monitors, 17: 27687 (NIRL/R/30)

H

HOUDRY PROCESS AND CHEMICAL CO., LINWOOD, PENNA.
Prog. rpt. on non-electrically conducting fine particulates, 3/61–9/62, 17: 27313 (ASD-TDR-62-843)

I

ILLINOIS INST. OF TECH., CHICAGO. ARMOUR RESEARCH FOUNDATION.
Formation and annealing of radicals in irradiated nitrates. III., 17: 27422 (TID-17105)

ILLINOIS. UNIV., URBANA.
Prog. rpt. on point defect-dislocation interactions, final, 11/61–10/62, 17: 27805 (TID-18859)
Prog. rpt. on properties of materials at low temperatures, final, 6/58–5/62, 17: 27804 (TID-18842)

INTERNATIONAL ATOMIC ENERGY AGENCY, VIENNA.
Bibliography on nuclear medicine, 17: 27067 (WP/22/5)
Prog. rpt. on dosimetry in human radioepidemiology, 17: 27062 (TID-18722)

IOWA STATE UNIV. OF SCIENCE AND TECHNOLOGY, AMES. INST. FOR ATOMIC RESEARCH.
Resistivity of vacancy impurity pairs, 17: 27776 (BNL-6358)

ISRAEL. ATOMIC ENERGY COMMISSION, REHOVOTH.
Activation analysis with nuclear reactor, 17: 27230 (IA-839)

ITALY. COMITATO NAZIONALE PER L'ENERGIA NUCLEARE, ISPRA.
Fluorine in urine of general population and exposed workman, 17: 27589 (CNI-111)

ITALY. COMITATO NAZIONALE PER L'ENERGIA NUCLEARE, ROME.
Extrusion fabrication of recycled thoria–urania, 17: 28471 (TID-7650 (p.553-84))
Natural tracing by seasonal variation of $^{18}O/^{16}O$ ratio in a ground water research, 17: 27565 (RT/GEO(63)-25)
PCUT—program for recycle of power reactor fuel, 17: 28461 (TID-7650(p.285-332))

ITALY. COMITATO NAZIONALE PER L'ENERGIA NUCLEARE. LABORATORI NAZIONALI, FRASCATI.
Unitary symmetry model for photoproduction, 17: 28149 (LNF-63/21)

ITALY. COMITATO NAZIONALE PER LE RICERCHE NUCLEARI. CENTRO DI STUDI NUCLEARI, ISPRA.
Fission products from fallout in lake biota, 17: 27588 (CNI-109)

ITALY. COMITATO NAZIONALE PER LE RICERCHE NUCLEARI. FRASCATI LABORATORI.
Determining spin of Ξ, 17: 28150 (LNF-63/31)

ITALY. ISTITUTO ITALIANO DI IDROBIOLOGIA, PALLANZA.
Fission products from fallout in Lake Biota, 17: 27588 (CNI-109)

ITALY. ISTITUTO SUPERIORE DI SANITÀ, ROME.
Absorption of π^- mesons in complex nuclei, 17: 28139 (ISS-63/28
Papers at Congress of National Laboratories in Frascati, 5/63, 17: 28138 (ISS-63/28)

J

JAPAN ATOMIC ENERGY RESEARCH INST., TOKYO.
Radiation effects on solid catalysts, 17: 27419 (JAERI-4024)

JOHNS HOPKINS UNIV., BALTIMORE.
Trucking of radioactive materials, 17: 27599 (NYO-9773)

JOINT INST. FOR NUCLEAR RESEARCH, DUBNA, U.S.S.R.
Accuracy of u, v transformation method, 17: 28242 (JINR-P-1259)
Algebraic equations for meson-nucleon scattering, 17: 28142 (JINR-E-1262)
Analysis of p-p interaction at 657 Mev. I., 17: 28147 (JINR-P-1266)
Calculation of the ρ trajectory, 17: 28145 (JINR-P-1246)
Effects of high-energy protons on Si photoelements, 17: 27891 (JINR-P-1247)
Half life of spontaneously fissionable isomer, 17: 28241 (JINR-P-1258)
Interacting fields of spin 1 and symmetry properties, 17: 28143 (JINR-P-1241)
Meson production in pp collisions at 660 Mev, 17: 28140 (JINR-D-1236)
Pole theory of Λ-hyperon production in π^--p interactions at high energies, 17: 28144 (JINR-P-1245)
Quasioptical potential in model of quantum field theory, 17: 28146 (JINR-P-1253)
Regularities in system of strange resonances, 17: 28148 (JINR-P-1287)

Relativistic causality in quantum mechanics of scalar particle, 17: 28141 (JINR-E-1252)
Relativistic hydrodynamic equations from relativistic kinetic equation, 17: 27939 (JINR-P-1261)

K

KANSAS. UNIV., LAWRENCE.
Laboratory experiments in radiation biology, 17: 27061 (TID-18616)
KERNFORSCHUNGSZENTRUM, KARLSRUHE, GERMANY.
Neutron cross sections for fast reactor materials. II., 17: 28245 (KFK-120)
KINNEY (A. M.), INC., CINCINNATI.
Hazards rpt. on University of Cincinnati Nuclear Research Center, 17: 28566 (NP-12915)
KNOLLS ATOMIC POWER LAB., SCHENECTADY, N. Y.
Aqueous corrosion of Zr single crystals, 17: 27748 (KAPL-2257)
Chloride stress corrosion cracking of Ni–Cr–Fe alloys, 17: 27749 (KAPL-M-CC-3)
FLOCK—program to obtain fitted self-shielding coefficients, 17: 28440 (KAPL-M-RPC-8)
Fuel element temperature lag during power transients, 17: 28438 (KAPL-M-BEE-1)
KARE input, Rev. V., 17: 27721 (KAPL-M-JA-6)
Neutron absorption rates in lumped poisons, 17: 28244 (KAPL-M-SW-2)
Power distributions in critical assemblies, 17: 28439 (KAPL-M-JNB-1)
Production of x-ray spectra, 17: 27242 (TID-18925)
Reactor technology—physics, 17: 28437 (KAPL-2000-20)
SWAK—thermal cross section program, 17: 28243 (KAPL-M-RPC-6)
TRAM for Philco 2000, 17: 28222 (KAPL-M-RPC-1(Rev.1))

L

LEBON ET CIE., PARIS.
Transport of irradiated reactor fuel, 17: 28562 (EUR-185.f,d,e)
LIBRARY OF CONGRESS. AEROSPACE INFORMATION DIV., WASHINGTON, D. C.
Bibliography on nuclear effects on propagation of electromagnetic waves, 17: 27937 (AID-62-155)
LOCKHEED GEORGIA CO., MARIETTA, GA.
Hazards rpt. on University of Cincinnati Nuclear Research Center, 17: 28566 (NP-12915)
LOCKHEED MISSILES & SPACE CO., PALO ALTO, CALIF.
Lubricants and thermal control materials under space conditions, 17: 27506 (NP-12906)
LOCKHEED MISSILES & SPACE CO., SUNNYVALE, CALIF.
Bibliography on thermodynamic properties of Mo and Nb, 17: 27793 (NP-12938)
Bibliography on electroluminescence, 17: 27946 (NP-12937)
LOS ALAMOS SCIENTIFIC LAB., N. MEX.
Bibliography of publications of LASL research, 17: 26946 (LAMS-2895)
Crystal structure of alpha Pu metal, 17: 27787 (LADC-5523)
Determination of traces of nitride N in Na, 17: 27232 (LA-2892)
Heats of dissociation of gaseous chlorides, 17: 27315 (LA-2841)
Howard Eberline neutron survey instrument PNC-1, 17: 27685 (LA-2860)
Integral γ and neutron measurements on Kiwi-B-4A, 17: 28572 (LA-2885)
Kinetics of reaction between Pu(VI) and Fe(II), 17: 27316 (LADC-5517)
Lens designing technique with LASL code for IBM 7090, 17: 27940 (LA-2877)
Prog. rpt. on LAMPRE program, 5/20/63, 17: 28565 (LAMS-2915)

M

MASSACHUSETTS INST. OF TECH., CAMBRIDGE.
Magnetohydrodynamics of partially ionized gases, 17: 27540 (NP-12767 (p.65-7))
Precision-encoded memory (PEM), 17: 26949 (TID-18887)
Prog. rpt. on organic reactor coolants, 1–9/62, 17: 28441 (MITNE-29)
MELLON INST., PITTSBURGH.
Energy transfer in ethane–ethylene mixtures, 17: 27406 (RRL-113)
MICHIGAN. UNIV., ANN ARBOR.
Activation analysis and the research reactor, 17: 27241 (TID-18908)
Theorems for neutron transport equation, 17: 28225 (TID-18885)
Wavelength-dependent effects of x rays on mammalian tissue cells, 17: 27057 (MMPP-196-2)
MICHIGAN. UNIV., ANN ARBOR. ENGINEERING RESEARCH INST.
Tests on models of nuclear reactor elements. I., 17: 28445 (NP-12925)
MONSANTO RESEARCH CORP. DAYTON LABS., OHIO.
Prog. rpt. on organic coolants, 1–3/63, 17: 28433 (IDO-11005)
MOUND LAB., MIAMISBURG, OHIO.
Prog. rpt. on reactor fuels and materials, 1–3/63, 17: 27789 (MLM-1156)

N

NARMCO RESEARCH AND DEVELOPMENT. DIV. OF TELECOMPUTING CORP., SAN DIEGO, CALIF.
Prog. rpt. on brazing refractory alloys, 2–4/63, 17: 27760 (NP-12901)
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION, WASHINGTON, D. C.
Liquid metal studies in France and Great Britain, 17: 27731 (NASA-TM-X-884)
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION. GODDARD SPACE FLIGHT CENTER, GREENBELT, MD.
Satellite observations of equatorial ionosphere, 17: 27941 (NASA-TN-D-1756)
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION. LEWIS RESEARCH CENTER, CLEVELAND.
Critical boiling heat flux for channels of various cross sections, 17: 27537 (NASA-TN-D-1656)
NATIONAL BUREAU OF STANDARDS, WASHINGTON, D. C.
Evaluation of large radiation exposures, 17: 27594 (NBS-TN-161)
NATIONAL CANNERS ASSN. WESTERN RESEARCH LAB., BERKELEY, CALIF.
Radioisotopic tracer techniques for detection and measurement of detergent residues, 17: 27637 (SAN-1020)
Radioisotopic tracer techniques for removal of pesticide residues from food, 17: 27638 (SAN-1021)
NATIONAL LEAD CO. OF OHIO, CINCINNATI.
Electron beam melting of U, 17: 27732 (NLCO-881)
Inversion of pole figures for materials having orthorhombic symmetry, 17: 27791 (NLCO-862(Rev.4))
Removal of foreign organic materials from TBP–kerosene solvent, 17: 27405 (NLCO-882)
NATIONAL RESEARCH COUNCIL. MATERIALS ADVISORY BOARD.
Research programs for rolling, 17: 27759 (MAB-139-M(R3))
NAVAL MEDICAL RESEARCH INST., BETHESDA, MD.
Protective shelters, 17: 27598 (NRL-5882)
NAVAL RADIOLOGICAL DEFENSE LAB., SAN FRANCISCO.
Fission product yields of thermonuclear explosion, 17: 28260 (USNRDL-TR-642)
Inhibition of thymidine kinase–DNA polymerase activity in kidney by x radiation, 17: 27066 (USNRDL-TR-640)
Lanthanum-140 as radiotracer in chemical explosions, 17: 27640 (USNRDL-TR-638)
NAVAL RESEARCH LAB., WASHINGTON, D. C.
Protective shelters, 17: 27598 (NRL-5882)
Transverse magnetoresistance of Al, 17: 27794 (NRL-5949)
NEW MEXICO. UNIV., ALBUQUERQUE. ENGINEERING EXPERIMENT STATION.
Descriptors for two-phase automatic data retrieval system, 17: 27724 (TID-18886)
NEW YORK. OFFICE OF ATOMIC DEVELOPMENT, ALBANY.
Radiation control in State of New York, 17: 27597 (NP-12924)
NEW YORK OPERATIONS OFFICE. HEALTH AND SAFETY LAB., AEC.
Prog. rpt. on fall-out program, 3–5/63, 17: 27592 (HASL-138)
NEW YORK UNIV., NEW YORK.
Implicit finite difference schemes for hyperbolic systems, 17: 27722 (NYO-10426)
NORTH AMERICAN AVIATION, INC., DOWNEY, CALIF.
Radiation effects on elastomers, 17: 27885 (AD-282467)
NORTH CAROLINA STATE COLL., RALEIGH.
Phase relationships in U–C–O system, 17: 27802 (TID-18809)
Prog. rpt. on applications of radioisotopes to textiles, 12/60–8/61,

17: 27634 (NCSC-2477-4)

NORTH CAROLINA. UNIV., CHAPEL HILL.

Irradiation and the nervous system, 17: 27194

Prog. rpt. on mutation in chromosomes of irradiated *Drosophila melanogaster*, final, 2/54–3/63, 17: 27064 (TID-18855)

NORTHERN STATES POWER CO., MINNEAPOLIS.

Pathfinder atomic power plant, 17: 28521 (ACNP-6112(Rev.1))

Pathfinder superheated steam heat transfer, 17: 28522 (ACNP-62030)

NORWAY. INSTITUTT FOR ATOMENERGI, KJELLER.

Analog computer model dynamics of Halden-I reactor, 17: 28529 (KR-45)

JEEPNIK—exponential facility, 17: 28564 (KR-46)

Preparation of Cr-51 by Szilard-Chalmers reaction, 17: 27420 (KR-40)

NUCLEAR DEVELOPMENT CORP. OF AMERICA, WHITE PLAINS, N. Y.

Splitting as function of energy, photoneutron production and variance calculation in MONSTER, 17: 28246 (NDA-Memo-2123-1)

NUCLEAR METALS, INC., CONCORD, MASS.

Prog. rpt. on metallurgy, 3/63, 17: 27733 (NMI-2116)

O

OAK RIDGE GASEOUS DIFFUSION PLANT, TENN.

Variable key weight cascade for multicomponent isotope separation, 17: 27712 (K-1571)

OAK RIDGE INST. OF NUCLEAR STUDIES, INC., TENN.

Prog. rpt. on medical studies, annual, 1962, 17: 26964 (ORINS-42)

OAK RIDGE NATIONAL LAB., TENN.

Aqueous processing of Th fuels, 17: 28464 (TID-7650(p.384-435))

Bibliography of literature examined by RSIC, 17: 28409 (ORNL-RSIC-1)

Catalog of radio and stable isotopes, ORNL, 17: 26961

CDC-1604 subroutine package for making linear, logarithmic, and semi-logarithmic graphs, 17: 27723 (ORNL-3447)

Decontamination of process water wastes. I., 17: 28582 (ORNL-3322)

Depth-dose distribution produced in spherical water-filled phantom, 17: 27059 (ORNL-3457)

Economic analysis of shipment of spent reactor fuel, 17: 28446 (ORNL-TM-590)

Effects of fission product removal on costs of waste management. V., 17: 28583 (ORNL-3357)

Fabrication of U–Mo–UO_2 and U–Mo–UC fuels, 17: 28531 (ORNL-3437)

FORTRAN program for calculating scattering of nucleons from nonlocal optical potential, 17: 28155 (ORNL-3429)

In-pile radiation corrosion experiments with Zr, Ti, and steel alloys in UO_2SO_4, 17: 27750 (ORNL-3099)

In-pile testing of circulating thoria suspensions, 17: 28478 (TID-7650 (p.696-720))

Kilorod facility, ORNL, 17: 28463 (TID-7650(p.351-83))

Molten salt and aqueous power reactors for Th utilization, 17: 28457 (TID-7650(p.194-209))

Polymerization, depolymerization and precipitation of Pu(IV) as functions of temperature, 17: 27319 (ORNL-TM-585)

Prog. rpt. on foam separation, 1–3/63, 17: 28584 (RAI-113)

Pump loops for materials testing, 17: 27507 (ORNL-3449)

Pyrolytic-carbon coated and uncoated uranium carbide particles, 17: 27796 (ORNL-TM-521)

Radiation hazards of recycled U^{233}–Th fuels, 17: 28460 (TID-7650 (p.253-84))

Reactor irradiation of thoria powders and pellets, 17: 28477 (TID-7650(p.675-95))

Review of Th reactor physics, 17: 28451 (TID-7650(p.57-75))

Sol gel process for preparation of thoria-base fuels, 17: 28469 (TID-7650(p.519-42))

Thorium Fuel Cycle Symposium, Gatlinburg, Tenn., 12/62, 17: 28447 (TID-7650)

Thorium fuel cycle development facility conceptual design, 17: 28462 (TID-7650(p.333-50))

Thorium fuel cycle irradiation program, 17: 28476 (TID-7650(p.643-74))

Thorium reserves in granitic rock, 17: 28450 (TID-7650(p.29-56))

Thorium utilization economics, 17: 28480 (TID-7650(p.738-61))

Vibratory-compaction studies on thoria–urania, 17: 28472 (TID-7650 (p.585-605))

Wettability of metals and alloys on Be, 17: 27795 (ORNL-3438)

OKLAHOMA. UNIV., NORMAN.

Measuring lifetimes of excited atomic states and application to He, 17: 27943 (NP-12903)

Prog. rpt. on sequestration of metal ions in brine using radioisotopes, final, 1962, 17: 27320 (ORO-602)

P

P.E.C. CORP., BOULDER, COLO.

Prog. rpt. on photo processes and collisions of 5 times ionized O, 3–5/63, 17: 27948 (TID-18921)

PARAMETRICS, INC., WALTHAM, MASS.

Prog. rpt. on Kr as universal tracer, 2–4/63, 17: 27639 (TID-18881)

Prog. rpt. on radiological mechanisms for geophysical research, annual, 1962, 17: 27564 (NYO-10219)

Radioisotope techniques for atmospheric density measurements, 17: 27656 (NYO-9854)

PASADENA FOUNDATION FOR MEDICAL RESEARCH, CALIF.

Study of RNA content and degree radioresistance, 17: 27060 (SAM-TDR-63-17)

PHILLIPS PETROLEUM CO., BARTLESVILLE, OKLA.

Catalysts for selective hydrocracking of polyphenyls, 17: 28434 (IDO-16858)

Catalytic hydrocracking of high boiler in reactor coolant, 17: 28435 (IDO-16877)

Electron radiolysis of benzene–*m*-terphenyl and perdeuterobenzene–*m*-terphenyl mixtures, 17: 27418 (IDO-16876)

PHILLIPS PETROLEUM CO. ATOMIC ENERGY DIV., IDAHO FALLS, IDAHO.

Potentiostat for electrochemical research, 17: 27653 (IDO-16852)

Prog. rpt. on analytical activities, annual, 1962, 17: 27231 (IDO-14605)

Prog. rpt. on Spert Project, 10–12/62, 17: 28436 (IDO-16890)

POLAND. BIURO PELNOMOCNIKA RZADU DO SPRAW WYKORZYSTANIA ENERGII JADROWEJ. CENTRALNE LABORATORIUM OCHRONY RADIOLOGICZNEJ, WARSAW.

Radioactivity in foodstuffs, Poland, 1959–1961, 17: 27587 (CLOR-15)

POLISH ACADEMY OF SCIENCES. INST. OF NUCLEAR RESEARCH. WARSAW.

Bibliography on chemical effects of nuclear transformations, 17: 27421 (NP-12894)

Fused Pu and U chlorides as fuel for fast breeder reactors, 17: 27797 (PAN-4141V)

High energy-photon-initiated E.A.S., 17: 28119 (PAN-382/VI)

PRATT AND WHITNEY AIRCRAFT DIV., UNITED AIRCRAFT CORP., HARTFORD, CONN.

Prog. rpt. on heat rejection in nuclear space powerplants, 12/62–2/63, 17: 28574 (PWA-2197)

PRINCETON UNIV., N. J.

Variation of neutral density with time in C-stellarator discharges, 17: 28348 (MATT-161)

R

RADIATION APPLICATIONS INC., LONG ISLAND CITY, N. Y.

Prog. rpt. on foam separation, 1–3/63, 17: 28584 (RAI-113)

RESEARCH TRIANGLE INST., DURHAM, N. C.

Prog. rpt. on double decomposition radio release analysis for Ca and phosphate ions, final, 1962, 17: 27233 (ORO-588)

ROCHESTER, N. Y. UNIV.

ϕ-Meson and unitary symmetry model, 17: 28154 (NYO-10264)

RUTGERS UNIV., NEW BRUNSWICK, N. J.

Final rpt. on high-temperature materials, 1/3/62, 17: 27798 (RADC-TDR-62-307)

Prog. rpt. on basic studies in gas-solid suspension, 12/62–3/63, 17: 27541 (TID-18909)

Prog. rpt. on basic studies in gas-solid suspension, 8–11/62, 17: 27542 (TID-18910)

S

SANDIA CORP., ALBUQUERQUE, N. MEX.

Bibliography on civilian application releases through 1962, 17: 26947 (SCR-600)

Descriptors for two-phase automatic data retrieval system, 17: 27724 (TID-18886)
Gamma-ray photoconductivity decay in organic dielectric materials, 17: 27895 (TID-18857)
Neutron effectiveness in producing photoconductivity in dielectric materials, 17: 27893 (TID-18843)
Radiation effects on lead zirconate titanate ferroelectrics, 17: 27894 (TID-18856)
SHAPE—FORTRAN language computer program, 17: 27509 (TID-18844)
Stress detection by infrared inspection, 17: 27508 (SCTM-59-63(25))

SANDIA CORP. LIVERMORE LAB., LIVERMORE, CALIF.
Conversion of electromagnetic energy into shock pulses, 17: 27947 (TID-18816)

SANDIA LAB., ALBUQUERQUE, N. MEX.
Dust-controlled vented hood, 17: 27600 (SC-4905(RR))

SAVANNAH RIVER OPERATIONS OFFICE, AEC.
Prog. rpt. on heavy water reactors, 5/63, 17: 28533 (SRO-83)

SCHOOL OF AEROSPACE MEDICINE, BROOKS AFB, TEX.
Study of RNA content and degree radioresistance, 17: 27060 (SAM-TDR-63-17)

SMITH (A. O.) CORP., MILWAUKEE.
Prog. rpt. on refractory metal oxides, final, 6/61–6/63, 17: 27788 (LRR-41)

SOCIETÀ ELETTRONUCLEARE NAZIONALE, ROME.
Prog. rpt. on SENN reactor, 12/62, 17: 28530 (NP-12909)

SOCIÉTÉ BELGE DE CHIMIE NUCLÉAIRE, BRUSSELS.
Radioelements in soil at Mol, 17: 27602 (EURAEC-416)
Treatment and storage of radioactive wastes, 17: 28579 (EURAEC-295)

SOCIÉTÉ GÉNERALE D'EXPLOITATIONS INDUSTRIELLES, PARIS.
Transport of irradiated reactor fuel, 17: 28562 (EUR-185.f,d,e)

SPACE TECHNOLOGY LABS., INC., LOS ANGELES.
Boson eigenstates in generalized field theory, 17: 28153 (NP-12904)

SPERRY PRODUCTS, INC., DANBURY, CONN.
Ultrasonic investigation of stainless steel weld overlay, 17: 27761 (TID-18871)

STANFORD RESEARCH INST., MENLO PARK, CALIF.
Economic benefits from Civilian Nuclear Power Program, 17: 28532 (SRIA-65)
Ignition of materials by large yield nuclear weapons, 17: 27945 (NP-12936)

T

TECHNICAL OPERATIONS RESEARCH, BURLINGTON, MASS.
Effect of partitions on dose rate in multistory windowless building, 17: 27601 (TO-B-63-6)

TENNESSEE. UNIV., KNOXVILLE.
Wettability of metals and alloys on Be, 17: 27795 (ORNL-3438)

TEXAS NUCLEAR CORP., AUSTIN, TEX.
Prog. rpt. on nuclear techniques in coal analysis, 5/62–1/63, 17: 27240 (TID-18883)

TEXAS. UNIV., DALLAS. SOUTHWESTERN MEDICAL SCHOOL.
Nucleolar responses to ionizing irradiation, 17: 27063 (TID-18846)

TOKYO UNIV.
Partition coefficients and reciprocal ionic radii, 17: 27562 (INSJ-54)

TRACERLAB. DIV. OF LAB. FOR ELECTRONICS, INC., RICHMOND, CALIF.
Electrostatic purification of He reactor-coolant, 17: 28484 (TID-18911)

TREFILERIES ET LAMINOIRS DU HAVRE, FRANCE.
FRITTOXAL technology, nuclear applications, 17: 27757 (EUR-273.f)

TURKEY. ATOMIC ENERGY COMMISSION. CEKMECE NUCLEAR RESEARCH CENTER, ISTANBUL.
Conversion factor of bare, critical multiplying media, 17: 28421 (CNAM-5)
Second order correction to average extrapolation length, 17: 28420 (CNAEM-8)

U

UNITED KINGDOM ATOMIC ENERGY AUTHORITY. AUTHORITY HEALTH AND SAFETY BRANCH. RADIOLOGICAL PROTECTION DIV., HARWELL, BERKS, ENGLAND.
Classification of radionuclides for transport purposes, 17: 27586 (AHSB (RP)R-23)

UNITED KINGDOM ATOMIC ENERGY AUTHORITY. PRODUCTION GROUP, SPRINGFIELDS, LANCS, ENGLAND.
Absorptiometric determination of Fe in Magnox MN 70, 17: 27234 (PG-Report-437)
Determination of total C in UC, 17: 27235 (PG-Report-444)
Determination of Fe in Magnox AL 80 and Magnox ZR 55 alloys, 17: 27236 (PG-Report-453)
Determination of Al in Magnox AL 80, 17: 27237 (PG-Report-454)

UNITED KINGDOM ATOMIC ENERGY AUTHORITY. PRODUCTION GROUP. CHEMICAL SERVICES DEPT., WINDSCALE, SELLAFIELD, ENGLAND.
Determination of residual gas in gaseous CO_2, 17: 27238 (PG-Report-463)
Determination of H_2O in TBP, 17: 27239 (PG-Report-467)

UNITED KINGDOM ATOMIC ENERGY AUTHORITY. REACTOR GROUP. ATOMIC ENERGY ESTABLISHMENT, WINFRITH, DORSET, ENGLAND.
Dragon core, 17: 28459 (TID-7650(p.244-52))
ERIC I. FORTRAN program for calculating resonance integrals, 17: 28238 (AEEW-M-304)
PIXSE in thermal reactor calculations, 17: 28417 (AEEW-M-318)
Release of I-131 in Zenith containment, 17: 28418 (AEEW-R-172)

UNITED KINGDOM ATOMIC ENERGY AUTHORITY. RESEARCH GROUP. ATOMIC ENERGY RESEARCH ESTABLISHMENT, HARWELL, BERKS, ENGLAND.
Film thickness and holdup measurements in vertical annular flow, 17: 27534 (AERE-M-1203)
Production of magnetic fields by superconductors, 17: 27936 (AERE-M-1207)
Release of inert gases from UO_2, 17: 27886 (AERE-M-969)
Surface ionization techniques in mass spectrometry, 17: 27225 (AERE-R-4295)

UNITED KINGDOM ATOMIC ENERGY AUTHORITY. RESEARCH GROUP. CHEMISTRY DIV., WOOLWICH OUTSTATION, ENGLAND.
Determination of radiorutheniun, 17: 27224 (AERE-AM-68)

UNITED KINGDOM ATOMIC ENERGY AUTHORITY. RESEARCH GROUP. CULHAM LAB., CULHAM, ABINGDON, BERKS, ENGLAND.
Impurity atoms in plasma possessing time varying electron temperature and density, 17: 28359 (CLM-R-3)

UNITED KINGDOM ATOMIC ENERGY AUTHORITY. WEAPONS GROUP. ATOMIC WEAPONS RESEARCH ESTABLISHMENT, ALDERMASTON, BERKS, ENGLAND.
Energy dissipation by electrons vertically incident on earth's atmosphere, 17: 28117 (AWRE-E-12/63)

UNITED NUCLEAR CORP. CHEMICALS DIV., HEMATITE, MO.
Final rpt. on characterization of UO_2 powders, 17: 27811 (UNC-1004)

UNITED STATES–EURATOM JOINT RESEARCH AND DEVELOPMENT PROGRAM.
Fission gas pressure in operating fuel elements, 17: 27651 (GEAP-4135)
Minutes of ceramic fuels meeting, Brussels, Oct. 1962, 17: 27734 (TID-7666)
Phase relationships in U–C–O system, 17: 27802 (TID-18809)
Prog. rpt. on high-performance UO_2 program, 4–6/62, 17: 28429 (GEAP-3771-5)
Prog. rpt. on Pu recycle for water moderated reactors, 1–3/63, 17: 28431 (GEAP-4216)
Prog. rpt. on thermal-stress-fatigue of stainless steels, 1–3/63, 17: 27775 (ATL-A-135)
Prog. rpt. on two-phase flow and boiling heat transfer, 4/63, 17: 27543 (NYO-10486)
Prog. rpt. on UO_2 extrusion, final, 3/63, 17: 27762 (EURAEC-368)
Radioelements in soil at Mol, 17: 27602 (EURAEC-416)
Treatment and storage of radioactive wastes, 17: 28579 (EURAEC-295)
Uranium oxide sintering with view to increasing thermal conductivity, 17: 27814 (EURAEC-103)

UPPSALA UNIV.
Bibliography on plasma physics, 17: 28361 (NP-12921)

UTAH STATE UNIV., LOGAN.
Thermodynamic study of Th–O system, 17: 27799 (TID-17092)

V

VIRGINIA POLYTECHNIC INST., BLACKSBURG.
Prog. rpt. on solution of neutron transport equation, 9–12/62, 17: 28224

(TID-18884)
VIRGINIA. UNIV., CHARLOTTESVILLE.
Prog. rpt. on Project SQUID, 12/62–3/63, 17: 27538 (NP-12767)

W

WEST VIRGINIA. UNIV., MORGANTOWN.
Modification of wood with polymers formed by radiation, 17: 27896 (TID-18907)
WESTINGHOUSE ELECTRIC CORP. ATOMIC POWER DIV., PITTSBURGH.
Boric acid solutions at high temperatures, 17: 27813 (WCAP-3713)
Ion exchange in boric acid solutions with radioactive decay, 17: 27493 (WCAP-3716)
Prog. rpt. on CVTR project, 1–3/63, 17: 28523 (CVNA-181)
WESTINGHOUSE ELECTRIC CORP. BETTIS ATOMIC POWER LAB., PITTSBURGH.
Changes associated with irradiation burnup of UO_2, 17: 27897 (WAPD-T-1501)
Computer program for analyzing pressure piping systems, 17: 27511 (WAPD-R(WB)-2)
Data flow and storage allocation for PDQ-5 program on Philco-2000, 17: 28228 (WAPD-T-1589)
Detailed time behavior of reactors, 17: 28485 (WAPD-T-1376)
Effects of Si, N, and O on corrosion zircaloy-2, 17: 27751 (WAPD-T-1567)
Production confidence in NDT methods, 17: 27560 (WAPD-T-1530)
Solution of transport equation in finite slab, 17: 28227 (WAPD-T-1392)
Use of FORTRAN in large programs, 17: 27725 (WAPD-T-1591)
WESTINGHOUSE ELECTRIC CORP. RESEARCH LABS., PITTSBURGH.
Current-carrying capacity of superconducting solenoids, 17: 27944 (NP-12908)
WISCONSIN. UNIV., MADISON.
Study of damped oscillating manometers. I. Newtonian fluids, 17: 27654 (LADC-5535)

Y

YALE UNIV., NEW HAVEN.
Interaction of radiation and matter in plasma, 17: 28358 (ARL-63-62)

PERSONAL AUTHOR INDEX

Each entry after an author's name is a shortened version of the title of the report or article, followed by the *NSA* volume and abstract number. Report numbers are given in parentheses.

The phrase "Progress report" is abbreviated as "Prog. rpt." This change permits a more rapid and complete alphabetical arrangement of the titles without changing the location of the progress report titles in relation to the other titles.

Because of problems involving the mechanical preparation of this index, all accent marks are omitted. The following changes in spelling have been introduced to reduce some of the confusion which might result from omitting the accents:

æ	becomes	ae
ö		oe
ø		oe
ü		ue (except in transliterated Chinese names)

A

AAMODT, R. L., Studies of Cs–CsF–Mo and Cs–CsF–W plasma diode emitters, 17: 27973

ABECASIS, S., Isomeric states of Y-90, 17: 28327

ABERLE, J. L., Liquid He supply systems for space simulators, 17: 28078

ABRAGAM, Anatole, Improvements in devices for measuring magnetic fields, 17: 27678

ABRAHAM, L., Thorium–UC fuel, 17: 28468 (TID-7650(p.498-518))

ABRAMOVA, L. V., Radiation synthesis of stannous dibromodibutyl, 17: 27481

ABRAMS, R. H., Jr., Nuclear generated plasmas in thermionic converters, 17: 27985

ABUSLEME, Isaac, Endoscopy and endophotography with Debray-Segal rectoscope, 17: 27183

ACKERMAN, Norman B., Prevention of hepatic metastasis by $CrP^{32}O_4$, 17: 27126

ACKERMANN, R. J., Thermodynamic study of Th–O system, 17: 27799 (TID-17092)

ADAMOV, V. S., Photochemical behavior of uranin in liquid and solid solutions, 17: 27399

ADAMS, M. D., Phase diagram Ca–Zn, 17: 27800 (TID-17136)

ADELL, M. Roca, Spectrochemical analysis of nuclear materials, 17: 27270

ADEMOLLO, M., Determining spin of Ξ, 17: 28150 (LNF-63/31)

ADKINS, C. J., Two-particle tunneling between superconductors, 17: 28037

ADLER, Hans H., Economic mineralogy and geology of Th, 17: 28449 (TID-7650(p.19-28))

ADLOFF, J.-P., Separation of radioelements by electrophoresis, 17: 27445

AEBI, H., Tritium content in organs after irradiation, 17: 27181

AFANAS'EVA, L. I., Determination of alkali metals, 17: 27243 (AEC-tr-5822)

AIKAWA, Jerry K., Magnesium in biologic processes, 17: 27052

AINTABLIAN, A. A., Radiation effects on photographic materials, 17: 27924

AIZAWA, Teruo, Photoneutron reaction of S-32, 17: 28286

AKTUERK, U., Simulation of pool boiling heat transfer, 17: 27550

ALBERTI, Giulio, Formation of highly fluorescent Zn phosphate, 17: 27262

ALBERTI, Rudolf, Disposal of radioactive waste, 17: 28586

AL'BITSKAYA, E. A., Concentration of 'hot' component of plasma, 17: 28376

ALDRED, A. T., Ferromagnetism in V–Fe and Cr–Fe alloys, 17: 27801 (TID-17141)

ALEKSANDRUK, V. M., Determination of absolute geologic age by Re method, 17: 27566 (AEC-tr-5858)

ALEKSEEVA, F. M., Density of high-melting powder compacts, 17: 27829

ALEXANDER, Frank J., Off-flavors in radiation sterilized beef, 17: 27648

ALEXANDER, K. F., Isomerism of In-116, 17: 28310

ALEXANDER, Lloyd G., Molten salt and aqueous power reactors for Th utilization, 17: 28457 (TID-7650(p.194-209))

ALFRED, Marc, Remote measurement of displacements of inaccessible members, 17: 27676

ALIMARIN, I. P., Chemistry of Np(V), 17: 27350

ALIMARIN, I. P., Separation of Np-239, 17: 27446

ALLEMANN, Rudolph T., Solidification of radioactive waste, 17: 28585

ALLES, Maurice, Machine for removing fuel elements, 17: 27525

ALMAGRO, J., Reversible and irreversible processes at Hg electrode. XVII., 17: 27328

ALMASY, A., Radiation-catalyzed chlorination of chlorinated pentane derivatives, 17: 27480

ALMQVIST, E., Spin-parity combinations for levels in Mg-24 and Si-28, 17: 28324

AMATO, I., Steam sintering of UO_2 pellets, 17: 27740

AMBLER, E., Helium-3 cryostat for oriented nuclei experiments, 17: 28092

AMIEL, Jean-Louis, Secondary syndrome in allogenic marrow transplantation, 17: 26971

AMIEL, S., Activation analysis with nuclear reactor, 17: 27230 (IA-839)

AMIRKHANOVA, I. B., Equilibrium vapor pressure ratios of two isotopes, 17: 28270

AMOS, W. R., Determination of Pu by (ethylene dinitrilo)-tetraacetic acid titration, 17: 27250

ANDERSON, A. R., Radiolysis of K dichromate in acid solution, 17: 27466

ANDERSON, E. E., Fission-product release from UC_2 particles, 17: 27784 (GA-4267)

ANDERSON, Harlan U., Ionization pressure gage sensitivities, 17: 27668

ANDERSON, T. P., Photography of Ar plasmas, 17: 28386

ANDERSON, D. C., Solution of transport equation in finite slab, 17: 28227 (WAPD-T-1392)

ANDREESCO, Ileana, Inelastic π^--nucleon interactions, 17: 28171

ANDREWS, Howard L., Ozone in radiation avoidance in the mouse, 17: 27175

ANDREWS, J. Robert, Early effects of radiation on renal function, 17: 27077

ANISOVICH, V. V., $K^+ \to 3\pi$ decay and $\pi\pi$ interaction, 17: 28211

ANKENBRANDT, C. M., Light collection efficiency of scintillation counters, 17: 27703

ANSELL, G. S., Mechanical properties of two-phase crystalline materials, 17: 27882

ANTIPOV, V. V., Effects of cosmic flight in a satellite vehicle on cytological and histological changes in hematopoietic organs of mice, 17: 27198

ANTOKU, Shigetoshi, Fetal disturbances due to radiation, 17: 27106

ANTONY, K. C., Prog. rpt. on Zr alloy design, 7–9/62, 17: 27728 (GEAP-

4076)
ANZANI, A., Instrumentation for health physics' measurements, 17: 27682 (EURAEC-14.i)
ANZANI, A., Measurements of ambient radioactivity—Ispra 1961, 17: 27591 (EUR-223.i)
APELGOT, Sonia, Self-decomposition of tritiated thymidine, 17: 27443
APPEL, Joachim, Effect of electron-electron scattering on metals, 17: 27923
ARAI, Tadashi, Electronic energies of diatomic molecules, 17: 27360
ARAKAWA, E. T., Bremsstrahlung from electron-bombarded thin Au foils, 17: 28313
ARAKI, H., Canonical commutation relations describing nonrelativistic infinite free Bose gas, 17: 28179
ARBUZOV, M. P., Crystalline structure of alloys in system Ni_3Al–Ni_3Nb, 17: 27828
ARCEN'EVA, M. A., Effects of cosmic flight in a satellite vehicle on cytological and histological changes in hematopoietic organs of mice, 17: 27198
ARCHIBALD, J. A., Jr., KARE input, Rev. V., 17: 27721 (KAPL-M-JA-6)
ARDEN, J. W., Determination of radioruthenium, 17: 27224 (AERE-AM-68)
ARIENT, M., Hematological changes in radiation sickness. IV., 17: 27202
ARMIJO, J. S., Prog. rpt. on Zr alloy design, 7–9/62, 17: 27728 (GEAP-4076)
ARMITAGE, G. S., Prog. rpt. on Be research, annual, 1962, 17: 27777 (CW-R&DL-31)
ARMOUR, S. F., Superheat strain-cycle capsule, 17: 28430 (GEAP-3933)
ARMSTRONG, Arthur A., Jr., Prog. rpt. on applications of radioisotopes to textiles, 12/60–8/61, 17: 27634 (NCSC-2477-4)
ARMSTRONG, J. R., Prog. rpt. on brazing refractory alloys, 2–4/63, 17: 27760 (NP-12901)
ARMSTRONG, Marjorie K., Measurement of early uptake of I-131 by thyroid, 17: 27048
ARMSTRONG, Philip E., Young's modulus measurements above 2000°C, 17: 27561
ARMSTRONG, Wallace D., Liquid food treating process, 17: 27223
ARNAUD, Y., Gamma spectrometric explorations on patients taking cure at Luchon, 17: 27042
ARNOLD, E. D., Radiation hazards of recycled U^{233}–Th fuels, 17: 28460 (TID-7650(p.253-84))
ARNOLD, W. D., Thorium reserves in granitic rock, 17: 28450 (TID-7650(p.29-56))
ARNOWITT, R., Note on uniqueness of canonical commutation relations, 17: 28023
ARON, P. R., Superconducting critical currents in wire samples, 17: 28101
ARRANCE, Franck C., Method for disposing of radioactive waste, 17: 28587
ASEFF, G. V., Sr., Shear loop for irradiation testing, 17: 28102
ASH, Milton, Bang-bang control of boiling moderator nuclear reactors, 17: 28540
ASHBY, D. E. T. F., Measurement of plasma density, 17: 28367
ASHBY, D. E. T. F., Wall evaporation in pulsed gas discharge, 17: 28027
ASHLEY, W. H., Determination of traces of nitride N in Na, 17: 27232 (LA-2892)
ASKILL, J., Self-diffusion in Mo, 17: 27868
ASPINALL, K. J., Classification of radionuclides for transport purposes, 17: 27586 (AHSB(RP)R-23)
ATHERTON, N. J., Emission spectrum of Pa, 17: 28062
ATKINSON, Colin, Improvements in energy absorbing devices, 17: 28505
AUERBACH, C., Test for sex-linked lethals in irradiated mice, 17: 27098
AVETISYAN, M. A., Photochemical behavior of uranin in liquid and solid solutions, 17: 27399
AVGUSTINIK, A. I., Kinetics of dispersion of some refractory materials, 17: 27873
AVIOLI, Louis V., Early effects of radiation on renal function, 17: 27077
AWAYA, Takashi, Experiment on $O^{18}(p,\gamma)F^{19}$ reaction, 17: 28290
AXFORD, W. I., Termination of solar wind and solar magnetic field, 17: 28111
AXTELL, S. L., Continuous Co-60 irradiation, 17: 27123
AXTMANN, Robert C., Existence of TBP monohydrate, 17: 27219
AXTON, E. J., Calibration of thermal neutron flux, 17: 28232
AYMARD, Jose, Machine for removing fuel elements, 17: 27525
AZHGIRI, L. S., Analysis of p-p interaction at 657 Mev. I., 17: 28147 (JINR-P-1266)

B

BAARLI, J., Ionization chamber for estimation of biological effectiveness of radiation, 17: 27056 (CERN-63-17)
BABERNICS, L., Radiation effects on properties of Ni, 17: 27483
BABISKIN, J., Transverse magnetoresistance of Al, 17: 27794 (NRL-5949)
BABKO, A. K., Rhodamine C as fluorescent reagent for In, 17: 27303
BABLSHKIN, F. A., Isotopic shift of spectral lines, 17: 27396
BABUSHKINA, L. G., Hygienic significance of natural radioactivity in mining, 17: 27603 (JPRS-19866)
BACLESSE, F., Supra-mammary localization of breast cancer, 17: 27006
BACQ, Z. M., Influence of certain metabolic factors on radiosensitivity, 17: 27047
BAETSLE, L., Radioelements in soil at Mol, 17: 27602 (EURAEC-416)
BAETSLE, L., Treatment and storage of radioactive wastes, 17: 28579 (EURAEC-295)
BAGNOLI, Laura, Radiation effects on root tips of *Avena sterilis*, 17: 27087
BAILEY, C. D., Foams and plastic films for insulation systems, 17: 28090
BAILEY, J. E., Oxidation of thin films of Zr, 17: 27754
BAINTON, K. F., Thermionic properties of UC, UC–ZrC, and Ta, 17: 27976
BAKER, D. G., Acute radiation injury in the alimentary tract, 17: 27211
BAKER, D. G., Intestine during acute radiation syndrome, 17: 27205
BAKER, D. G., Radiation. The cellular approach, 17: 27136
BAKER, D. G., Radioresistance, 17: 27143
BAKER, F. B., Kinetics of reaction between Pu(VI) and Fe(II), 17: 27316 (LADC-5517)
BAKER, J. E., In-pile radiation corrosion experiments with Zr, Ti, and steel alloys in UO_2SO_4, 17: 27750 (ORNL-3099)
BAKH, N. A., Effect of I on electrical properties of polyethylene, 17: 27434
BAKUSHINSKII, A. B., Dipole structure and internal electric fields in $PbZrO_3$, 17: 27393
BALDWIN, John N., Acute radiation nephritis, 17: 27203
BALESTIC, F., Radiochemical synthesis of compounds of biological interest, 17: 27473
BALOCK, J. W., Radiation effects on stages of fruit fly species, 17: 27120
BANKS, Charles V., Determination of O in V, Nb, and Ta, 17: 27257
BANKS, Dorothy, Destaining of stripping-film radioautographs, 17: 26988
BANNING, R. O., Prog. rpt. on brazing refractory alloys, 2–4/63, 17: 27760 (NP-12901)
BANWELL, C. N., Analysis of high-resolution NMR spectra. I., 17: 28293
BARANOV, S. A., Alpha decay of Am-241, 17: 28297
BARASHENKOV, V. S., Pole theory of Λ-hyperon production in π^--p interactions at high energies, 17: 28144 (JINR-P-1245)
BARASHENKOV, V. S., Regularities in system of strange resonances, 17: 28148 (JINR-P-1287)
BARBER, Barry, Construction of cavity ionization chamber, 17: 27163
BARBER, D., Observation of the radiation from Jupiter, 17: 28114
BARDINA, N. G., Kinetics of electrochemical processes on oxidized electrodes. II., 17: 27397
BARKALOV, I. M., Radiation polymerization of acetylene hydrocarbons, 17: 27477
BARKALOV, I. M., Radiation polymerization in the solid phase, 17: 27484
BARKER, H. A., Glutamate isomerase reaction, 17: 26981
BARNES, Hale, Joints between tubes of dissimilar materials, 17: 27529
BARRER, Lester, Chronic internal irradiation in humans, 17: 27150
BARRINGER, H. S., Water-cooled Th reactors, 17: 28456 (TID-7650 (p.172-93))
BARTELL, L. S., Significance of bond lengths determined by electron diffraction, 17: 27358
BARTLETT, A. A., Level structure of Sc-44, 17: 28249 (UCOL-P-518)
BARTLETT, E. S., Tensile behavior of Mo–Ti, Cb–W–Mo–Zr, and Ta–W, 17: 27878
BARTLETT, Neil, Fluorides of Xe and Rn, 17: 27327
BARWOOD, I. F., $\alpha \rightarrow \beta$ Phase transformation in U, 17: 27851
BAR'YAKHTAR, V. G., Scattering of slow neutrons by complex magnetic structures, 17: 28236
BASCHIERI, I., Pulmonary metastases from thyroid carcinoma, 17: 26998
BASCHIERI, I., Scintigraphy in study of metastases of thyroid adenocarcinoma, 17: 26996
BASERGA, Renato, Destaining of stripping-film radioautographs, 17: 26988

BASERGA, Renato, Semiquantitative radioautography with tritiated compounds, 17: 27010
BASKIN, Y., Phase studies in $MgO–Ta_2O_5$, 17: 27834
BASOVA, K. T., Electron and hole mobility ratio in InSb, 17: 27831
BASS, L., Heat balance of earth, 17: 27578
BASSI, A., Chemical polishing for UO_2, 17: 27763
BASSO, P., Calculations of thermal utilization factor, 17: 28230
BATE, George L., Cross sections for deuteron-induced fission, 17: 28314
BATE, L. C., Nuclear methods of O analysis, 17: 27293
BATES, J. L., Irradiation of defected UO_2 swaged rod, 17: 27890 (HW-62762)
BATTER, John F., Effect of partitions on dose rate in multistory windowless building, 17: 27601 (TO-B-63-6)
BATTLE, Norman, Improvements in or relating to pumps, 17: 27524
BATTLE, Norman, Improvements in nuclear power plant, 17: 28550
BATZENSCHLAGER, A., Sarcoma of liver and hepatic thorotrastosis, 17: 27081
BAUER, A., Angular transmitter for loading machine of the Dragon, 17: 28539
BAUER, A. A., Engineering properties of Th–U compounds, 17: 28466 (TID-7650(p.454-67))
BAUER, A. A., Thorium–U and Th–U base alloys for breeder applications, 17: 28467 (TID-7650(p.468-97))
BAUER, Stefan George, Improvements in or relating to pumps, 17: 27524
BAUER, Stefan George, Improvements in nuclear power plant, 17: 28550
BAUM, S. J., Deuterium isotope effect in intramolecular insertion, 17: 27411
BAUM, S. J., Recommended radiation exposures for space missions, 17: 27605
BAUN, William L., Infrared absorption spectra of rare earth oxides, 17: 27840
BAUN, William L., Phase transformation in hafnia and zirconia, 17: 27876
BAVLEY, Harold, Control of ionizing radiation in Massachusetts industry, 17: 27615
BAYER, Michael Adolf, Moderator core structures for nuclear reactors, 17: 28510
BAYLES, Byron, Superconducting alloys of the $Nb_3Sn_xM_{1-x}$ type, 17: 27861
BEALL, R. T., Foams and plastic films for insulation systems, 17: 28090
BEARSE, R. C., First and second excited levels of Ne-19, 17: 28298
BEAUDRY, B. J., Scandium–Y and Sc–Zr system, 17: 27785 (IS-569)
BEAUDRY, B. J., Welding Ta for high-temperature applications, 17: 27768
BEAVER, David L., Electron microscopy of Bi inclusions, 17: 27021
BECCHINI, M. F., Diagnosis of genital tumors with radioisotopes, 17: 26995
BECCHINI, M. F., Indicator methodology for diagnosis of tumors by means of radioisotopes, 17: 26992
BECKER, Kurt M., Convective heat transfer from horizontal cylinder rotating in pool of water, 17: 27533 (AE-107)
BECKER, Kurt M., Void fractions for flow of boiling D_2O, 17: 27532 (AE-106)
BECKMANN, Herbert, Magnetic induction parameter for Lorentz accelerators, 17: 28366
BEER, J., Fibrinolytic activity in radiation in dogs, 17: 27212
BEERBOWER, Alan, Radiation-resistant mineral oils, 17: 27530
BEISAW, Norman E., Effect of whole-body x irradiation on rats, 17: 27124
BELCHER, R., Precipitation with N-benzoylphenylhydroxylamine acetate, 17: 27299
BELL, Alan, Improvements in steam generators, 17: 27557
BELL, Alan, Improvements in pressurized water reactors, 17: 28506
BELL, Alan, Improved mechanical joint, 17: 28516
BELL, Francis Robert, Nuclear power plant, 17: 28559
BELL, Jerry R., Methods to determine Co-60 disintegration rate, 17: 27462
BELL, L. G., Creep of zircaloy-2 pressure tubes, 17: 27822
BELLI, Giuseppe, Causal relationship between damage and nuclear incidents, 17: 26950
BELLOBONO, Ignazio Renato, Gamma effects on Fe thiocyanate solutions, 17: 27440
BELOBRAGINA, G. V., Hygienic significance of natural radioactivity in mining, 17: 27603 (JPRS-19866)
BELONOGOV, A. V., Refractive index of liquid H, 17: 28035
BELYAEVA, G. F., Interaction between Ni_3Al and Ni_3Nb, 17: 27827
BEM, Yo., Peripheral pion-nucleon interactions, 17: 28208
BEMDEN, Emile Vanden, Plutonium, 17: 27738
BENASSI, E., Influence of immune reactions on radiosensitivity of tumors, 17: 27142
BENCO, A., Measurements of ambient radioactivity—Ispra 1961, 17: 27591 (EUR-223.i)
BEN DANIEL, David J., Ionization transients in Cs, 17: 28043
BENEDETTI, G. A., Scintigraphy in study of metastases of thyroid adenocarcinoma, 17: 26996
BENSON, Philip A., Iron content of stainless steel microspheres, 17: 27253
BENSTED, J. P. M., Late effects of thorotrast in mice, 17: 26972
BENTON, F. D., Buckling and void effects in D_2O moderated, organic, or H_2O cooled lattices, 17: 28483 (TID-18895)
BERDJIS, C. C., Protracted effects of repeated doses of x irradiation in rats, 17: 27094
BERDNIKOV, N. B., Intensity of H and deuterium lamps, 17: 28033
BERESTETSKII, V. B., Asymptotic behavior of scattering amplitudes, 17: 28212
BERG, A., Fission products from fallout in lake biota, 17: 27588 (CNI-109)
BERGDORF, C. G., Liquid metal flowmeter, 17: 27655 (NAA-SR-Memo-6117)
BERGMAN, Bo, Gamma analysis of elements in human mandibular compact bone, 17: 27014
BERKNER, Klaus H., Diffusion from line source in magnetic field, 17: 28365 (UCRL-10801)
BERKNER, Klaus H., Excitation and Lorentz ionization of 10-Mev hydrogen atoms, 17: 27950 (UCRL-10802)
BERKOV, A. V., π Meson production by μ mesons on nuclei, 17: 28341
BERLINER, Martha D., Action of uv on luminescence in *Armillaria mellea*, 17: 27179
BERNICK, Robert W., Uranium, 17: 26952
BERNICK, Sol, Rat reticuloendothelial system and endocrine gland responses to foreign particles, 17: 26967
BERNSTEIN, W., Oscillations in synthetic plasma beams, 17: 28394
BERTOLACCINI, M., Amplitude distribution of photomultiplier response, 17: 27659
BERTRAND, R., Separation of radioelements by electrophoresis, 17: 27445
BERULAVA, B. G., Paramagnetic resonance of U and Tb, 17: 27864
BESLIU, M. Colin, Inelastic π^--nucleon interactions, 17: 28171
BESLIU, Tatiana, Inelastic π^--nucleon interactions, 17: 28171
BETTS, D. S., Viscosity of liquid He-3, 17: 28036
BHATTACHARYA, G. C., Thiocyanates of alkaline-earth metals, 17: 27332
BHUTANI, M. M., Adsorption of P-32 by $SrSO_4$, 17: 27363
BIAGINI, Carissimo, Late pathological effects of acute irradiation in mammals, 17: 27146
BIANCHI, V., Intestinal absorption of Ca-45 in senile osteoporosis, 17: 27017
BIBB, A. E., Aqueous corrosion of Zr single crystals, 17: 27748 (KAPL-2257)
BIBERMAN, L. M., Energy emitted in spectral lines by plasma, 17: 28385
BIBRON, R., Tritium in rain, 17: 27292
BICKERDIKE, Robert Lewis, Tubular carbon articles, 17: 27772
BIERY, John C., Study of damped oscillating manometers. I. Newtonian fluids, 17: 27654 (LADC-5535)
BIGGERS, R. E., Polymerization, depolymerization, and precipitation of Pu(IV) as functions of temperature, 17: 27319 (ORNL-TM-585)
BILKIEWICZ, J., Radioactivity in foodstuffs, Poland, 1959–1961, 17: 27587 (CLOR-15)
BINGHAM, C. D., Determination of C in Na, 17: 27317 (NAA-SR-7918)
BIRD, Leonard L., Prog. rpt. on radiological mechanisms for geophysical research annual, 1962, 17: 27564 (NYO-10219)
BIRD, Leonard L., Radioisotope techniques for atmospheric density measurements, 17: 27656 (NYO-9854)
BIRKELUND, O. R., Preparation of Cr-51 by Szilard-Chalmers reaction, 17: 27420 (KR-40)
BIRKHOFF, R. D., Bremsstrahlung from electron-bombarded thin Au foils, 17: 28313
BIRMINGHAM, B. W., Solid formation in flowing cryogenic fluids, 17: 28084
BIRNBAUM, H. K., Prog. rpt. on point defect-dislocation interactions, final,

11/61–10/62, 17: 27805 (TID-18859)
BISHOP, D. M., One center wave functions for H, 17: 27366
BLACK, Robert E., Method for determining fluid flow in a conduit, 17: 27680
BLAESSER, G., ECO—critical experiment for study of ORGEL lattice, 17: 28427 (EUR-130.f)
BLAESSER, G., Reactivity for different types of fuel cycles, 17: 28426 (EUR-129.f)
BLAKEWOOD, Charles H., Energy storage device, 17: 28104
BLANC, Daniel, Spark chamber, 17: 27700
BLANCHARD, Bruno, Hydrocarbons from hydrolysis of mixtures of UC and UO_2, 17: 27409
BLANCHARD, F. A., Reduction of liquid scintillation counting data, 17: 27274
BLANCO, R. E., Aqueous processing of Th fuels, 17: 28464 (TID-7650 (p.384-435))
BLANN, Marshall, Reactions induced in Ni-58 with deuterons, 17: 28317
BLANQUET, P., Gamma spectrometric explorations on patients taking cure at Luchon, 17: 27042
BLEVINS, E. L., Capture/fission ratio of U-233 for epithermal neutrons, 17: 28309
BLIGH, P. H., Metabolism of Sr and Ba in the rat, 17: 27029
BLOCKLEY, Gwillym John, Nuclear reactors, 17: 28518
BLOESS, D., Lifetime of excited levels of Ca-42, 17: 28333
BLOKH, G. A., Radiation effects on rubber–plastic systems, 17: 27931
BLOKHINTSEV, D. I., Pole theory of Λ-hyperon production in π^--p interactions at high energies, 17: 28144 (JINR-P-1245)
BLOMEKE, J. O., Effects of fission product removal on costs of waste management. V., 17: 28583 (ORNL-3357)
BLOMSTRAND, J., Dragon core, 17: 28459 (TID-7650(p.244-52))
BLOSS, W., Investigations on noble gas-filled thermionic converters, 17: 27981
BLOSSER, T. V., Depth-dose distribution produced in spherical water-filled phantom, 17: 27059 (ORNL-3457)
BLOTT, B. H., Work function in tubes with cathodes of U and Zr carbides, 17: 27975
BLUM, Pierre, Hydrocarbons from hydrolysis of mixtures of UC and UC_2, 17: 27409
BLUMENTHAL, B., Metallurgical studies of Th–U–Pu alloys, 17: 28470 (TID-7650(p.543-52))
BLUMLE, L. J., Satellite observations of equatorial ionosphere, 17: 27941 (NASA-TN-D-1756)
BOBYR, V. V., Neutron scattering by Mg at 14 Mev, 17: 28276
BOCHE, R. D., Continuous Co-60 irradiation, 17: 27123
BOCHIROL, Louis, Improvements in low-temperature irradiation, 17: 28570
BOEUF, G., Preparation of I^{131}-labeled insulin, 17: 27032
BOGHEN, J., FRITTOXAL technology, nuclear applications, 17: 27757 (EUR-273.f)
BOHLMANN, E. G., In-pile testing of circulating thoria suspensions, 17: 28478 (TID-7650(p.696-720))
BOHR, N., Measurability of electromagnetic field quantities, 17: 27952 (UCRL-Trans-957(L))
BOLAND, Paul, Prog. rpt. on materials for high-temperature nuclear application, 1–4/63, 17: 27807 (TID-18891)
BOLEY, Forrest I., Hydromagnetic wave propagation near ion cyclotron resonance, 17: 28391
BOLING, E. A., Vise-configuration β counter, 17: 27694
BOLKOW, Ludwig, Apparatus for influencing a flowing plasma, 17: 28404
BOLLUM, F. J., Ultraviolet inactivation of DNA primer activity. I., 17: 27080
BOLOTIN, H. H., Double isomerism in As-73, 17: 28319
BOLOTOVSKII, V. M., Vavilov–Cherenkov radiation in isotropic optically active medium, 17: 28186
BOLSTERLI, M., Treatment of exchange in scattering processes, 17: 28194
BOLT, R. O., Prog. rpt. on radiolysis of organic fluids. Annual, 10/61–9/62, 17: 27423 (TID-18195)
BOMAR, S. H., Prog. rpt. on materials for high-temperature nuclear application, 1–4/63, 17: 27807 (TID-18891)
BONDA, Robert, Chronic internal irradiation in humans, 17: 27150
BONNAURE, P., ECO—critical experiment for study of ORGEL lattice, 17: 28427 (EUR-130.f)
BONNEFOY, Jorge, Endoscopy and endophotography with Debray-Segal rectoscope, 17: 27183
BORG, Richard J., Comments on the article diffusion in Co–Ni alloys, 17: 27841
BORISOV, A. V., Equilibrium vapor pressure ratios of two isotopes, 17: 28270
BOSCH, H., Isomeric states of Y-90, 17: 28327
BOTTOM, Alan Edward, Chemical polishing of Be, 17: 27745
BOUCHEZ, R., Scattering of 14-Mev neutrons from C-12, 17: 28301
BOULEAU, M., Grain boundaries in U–Mo alloys, 17: 27855
BOURDEAU, R. E., Ionospheric research from space vehicles, 17: 28060
BOURGEOIS, Michel, Preparation of U compounds, 17: 27403
BOWDEN, Piers, Generation of dislocations in metals, 17: 27920
BOWDEN, Robert L., Jr., Prog. rpt. on solution of neutron transport equation, 9–12/62, 17: 28224 (TID-18884)
BOYLE, W., Modification of wood with polymers formed by radiation, 17: 27896 (TID-18907)
BRAAMS, R., Partially damaged molecules after irradiation, 17: 27114
BRACE, Kirkland C., Early effects of radiation on renal function, 17: 27077
BRADSHAW, R. L., Effects of fission product removal on costs of waste management. V., 17: 28583 (ORNL-3357)
BRAGINSKII, V. B., Limits of measuring gravitational effects, 17: 28065
BRAILSFORD, A. D., Interstitial atoms and vacancies in alpha U, 17: 27852
BRAILSFORD, A. D., Radiation effects on U thermal conductivity, 17: 27911
BRANDES, Ely M., Economic benefits from Civilian Nuclear Power Program, 17: 28532 (SRIA-65)
BRANDON, D. G., Generation of dislocations in metals, 17: 27920
BRANSON, P. E., Performance of miniature glass dosimeters, 17: 27683 (HW-66728)
BRANSTETTER, J. R., Spectral emissivities of electrode materials, 17: 27979
BRAY, A. P., Performance of Core II, NS *Savannah*, 17: 28527 (GEAP-3828)
BRAY, L. A., Cesium-dipicrylamine solvent extraction studies, 17: 28580 (HW-76222)
BRAZOS, J. N., Power distributions in critical assemblies, 17: 28439 (KAPL-M-JNB-1)
BRENIG, W., Functional method for condensed systems, 17: 28201
BRENNER, S. N., Prog. rpt. on two-phase flow and boiling heat transfer, 4/63, 17: 27543 (NYO-10486)
BRICKLEY, S. G., Lattice constants of UC and UC_2, 17: 27815 (NP-tr-1027)
BRIGID, M., Hospital dietary service disaster program, 17: 27609
BRINCKMANN, H. F., Isomerism of In-116, 17: 28310
BRINDLEY, J. H., Hydraulic studies of proposed 9-rod SRE 3rd core fuel element, 17: 28443 (NAA-SR-Memo-8406)
BRINKMAN, J. A., Electron irradiation of ordered Cu_3Au, 17: 27892 (NAA-SR-Memo-504)
BRISCOE, M. G., Photography of Ar plasmas, 17: 28386
BRITIKOV, E. A., Effect of pollen irradiated with x rays on self-fertilization of corn, 17: 27091
BRITT, H. C., Fission fragment response in semiconductor detectors, 17: 27702
BRIXNER, Berlyn, Lens designing technique with LASL code for IBM 7090, 17: 27940 (LA-2877)
BROADMAN, G. A., Maximum fuel plate temperature in light water moderated research reactor, 17: 28567 (UCRL-7214)
BRODSKII, A. M., Formation of μ^+ mesic molecules, 17: 28342
BROEK, H. W., FORTRAN programs for computing angular distributions, 17: 28239 (ANL-6718)
BRONSHTEYN, F. V., Radiation effects on rubber–plastic systems, 17: 27931
BROOKSBANK, R. E., Kilorod facility, ORNL, 17: 28463 (TID-7650 (p.351-83))
BROSENS, P., Thermionic energy converter with liquid collector, 17: 27987
BROWN, Anthony Reginald George, Tubular carbon articles, 17: 27772
BROWN, F., Range of Xe-133 and Ar-41 ions in Al, 17: 28001
BROWN, F., Range of inert gas ions in metals, 17: 28002
BROWN, Harry L., Young's modulus measurements above 2000°C, 17: 27561
BROWN, K. B., Thorium reserves in granitic rock, 17: 28450 (TID-7650

(p.29-56))
BROWN, L. J., Studies of Cs–CsF–Mo and Cs–CsF–W plasma diode emitters, 17: 27973
BROWN, R. H., Potentiostat for electrochemical research, 17: 27653 (IDO-16852)
BROWN, Sidney O., Low-dose radiation effects on litters of albino rat, 17: 27170
BROWN, W. B., Determination of Pu by (ethylene dinitrilo)-tetraacetic acid titration, 17: 27250
BROWNELL, G. L., Medical use of reactors, 17: 27162
BRUGSCH, Heinrich G., Control of ionizing radiation in Massachusetts industry, 17: 27615
BRYAN, C. J., Radiation-induced cyanogenation of organic liquids, 17: 27437
BUDOV, G. M., Radiochemical studies of electrode processes on amalgams. II., 17: 27398
BUERGEL, B., Investigation of MHD generators, 17: 27997
BUGYAKI, L., Irradiated foodstuffs and radiomimetic effects, 17: 27027
BUKOWSKA, Barbara, Changes in intestinal microflora in x-irradiated rats, 17: 27074
BULLOCK, Frederick W., Beta-decay branching ratio of the Λ hyperon, 17: 28192
BULYGINA, L. A., Polymerization of vinylidene fluoride under γ irradiation, 17: 27470
BUNCH, W. L., Radiation shielding program, 17: 28408 (HW-SA-3032)
BURCH, G. E., Biologic half life of Mg-28 in the dog, 17: 27022
BURDITT, A. K., Jr., Radiation effects on stages of fruit fly species, 17: 27120
BURGE, E. J., Scintillation of liquid Ar, 17: 28059
BURGERS, J. M., Collisional damping of plasma oscillations, 17: 28387
BURKE, George W., Jr., Radioactivity standards for water, 17: 27613
BURKHARDT, James L., Prog. rpt. on fast wave plasma amplifier, 11/20/62, 17: 28357 (AD-290086)
BURNHAM, J. U., Characteristics of neon–alcohol spark chamber, 17: 27697
BURNS, W. A., Neutron irradiation and cold work effects on Zy-2, 17: 27729 (HW-76636)
BURR, Robert E., Electron microscopy of Bi inclusions, 17: 27021
BURREN, J. W., Geometrical reconstruction of bubble chamber tracks, 17: 27686 (NIRL/R/14)
BURROUGHS, J. C., Thyroidal I-131 uptake rate in infants, 17: 27020
BURROUS, M. L., Prog. rpt. on radiolysis of organic fluids. Annual, 10/61–9/62, 17: 27423 (TID-18195)
BUSH, Elizabeth T., Measuring liquid scintillation counting efficiencies, 17: 27689
BUTCHER, B. R., $\alpha \rightarrow \beta$ Phase transformation in U, 17: 27851
BUTEMENT, F. D. S., Method for radiochemical separation of Mo, 17: 27264
BUTLER, Graham Frederick, Improvements in nuclear reactors, 17: 28515
BYKOV, V. P., Electron packets of a microtron, 17: 28352
BYRNES, D. E., Boric acid solutions at high temperatures, 17: 27813 (WCAP-3713)
BYSTRITSKY, I., Meson production in pp collisions at 660 Mev, 17: 28140 (JINR-D-1236)

C

CABELL, M. J., Ratio of thermal capture to fission for Pu-239, 17: 28277
CAGLIOTI, V., Solid-state polymerization of phosphonitrilic chloride, 17: 27474
CAILLAT, R., Collection of He in sintering of BeO, 17: 27912
CALAMAI, Giulio, Scattering of electromagnetic radiation. I., 17: 28169
CALAMAI, Giulio, Scattering of electromagnetic radiation. II., 17: 28170
CALLAWAY, R. F., Shear loop for irradiation testing, 17: 28102
CAMBEL, A. B., Compressible magnetogasdynamic boundary-layer flow, 17: 28010
CAMBEL, Ali Bulent, Photography of Ar plasmas, 17: 28386
CAMERA, V., Fluorine in urine of general population and exposed workman, 17: 27589 (CNI-111)
CAMERERO, Ernesto Gorcia, Interactions $\pi^- + C$ at 915 Mev. I., 17: 28199
CAMONA, G., Chemical polishing for UO_2, 17: 27763
CAMPANINI, Mario, Testing of Latina Power Plant, 17: 28537
CAMPBELL, John Graham, Treatment of C and graphite articles, 17: 27884
CANALI, U., Shielding of ORGEL critical experiment, 17: 28428 (EUR-149.f)
CANFIELD, F. B., Helium–N system, 0° to –140°C, 17: 28077
CANIGGIA, A., Intestinal absorption of Ca-45 in senile osteoporosis, 17: 27017
CANNON, M. C., Thermodynamic study of Th–O system, 17: 27799 (TID-17092)
CARACOCHE, M. C., Isomeric states of Y-90, 17: 28327
CARDOZO, R. Lopez, Treatment and storage of radioactive wastes, 17: 28579 (EURAEC-295)
CARENZA, P., Iron-59 erythrocyte incorporation in hemolytic conditions, 17: 27015
CARO, Rafael, Calculation of thermal reactors, 17: 26951
CARPENDER, J. W. J., Supervoltage radiation therapy, 17: 27003
CARPENTER, D. L., Whistler measurements of electron density, 17: 28020
CARPENTER, F. D., Thermionic cathode systems for fission-heat conversion, 17: 27960
CARPENTER, James F., Final rpt. on characterization of UO_2 powders, 17: 27811 (UNC-1004)
CARPENTER, L. G., Prog. rpt. on hydrazine process, 2–4/63, 17: 27414 (ASD-TR-7-840A(IX))
CARPENTER, S. G., Epithermal Th reactor physics, 17: 28453 (TID-7650(p.88-127))
CARRABINE, J. A., Phases in commercially pure Be, 17: 27856
CARREA, A. J., Sintering of UO_2 in H, 17: 27488
CARROLL, D. F., System PuO_2–ZrO_2, 17: 27836
CARROLL, J. G., Prog. rpt. on radiolysis of organic fluids. Annual, 10/61–9/62, 17: 27423 (TID-18195)
CARRUTHERS, E. J., Continuous Co-60 irradiation, 17: 27123
CARTOUZOU, C., Preparation of I^{131}-labeled insulin, 17: 27032
CASE, K. M., Theorems for neutron transport equation, 17: 28225 (TID-18885)
CASIMIR, H. B. G., Interaction between atomic nuclei and electrons, 17: 28345
CASINI, G., ECO—critical experiment for study of ORGEL lattice, 17: 28427 (EUR-130.f)
CASINI, G., Reactivity for different types of fuel cycles, 17: 28426 (EUR-129.f)
CASINI, G., Xenon effect on reactivity, 17: 28425 (EUR-102.f)
CATINO, Antonio, Autoradiographic quantitative determination of U, 17: 27266
CATTERALL, J. A., Soft x ray L_{α_1} emission spectrum from liquid Al, 17: 27865
CELLINI, R. Fernandez, Spectrochemical analysis of nuclear materials, 17: 27270
CENERINI, R., ECO—critical experiment for study of ORGEL lattice, 17: 28427 (EUR-130.f)
CHALAYA, Z. I., Rhodamine C as fluorescent reagent for In, 17: 27303
CHALDYSHEV, V. A., Electron energy spectrum in Th_3P_4-type crystals, 17: 27391
CHAMBERS, F. W., Jr., Miniature tissue equivalent ion chambers, 17: 27076
CHAMPEIX, L., Analysis of O in Na, 17: 27245 (AEC-tr-5840)
CHAND, Ramesh, K^--deuterium interactions, 17: 28263
CHANDRASEKHAR, B. S., Current-carrying capacity of superconducting solenoids, 17: 27944 (NP-12908)
CHANDRASEKHAR, B. S., High-field superconducting magnets, 17: 28074
CHANG, M. C., Effects of x irradiation of ovarian ova, 17: 27119
CHANG, T. C., Supervoltage radiation therapy, 17: 27003
CHAO, C., Final rpt. on high-temperature materials, 1/3/62, 17: 27798 (RADC-TDR-62-307)
CHAO, C. F., Descriptors for two-phase automatic data retrieval system, 17: 27724 (TID-18886)
CHAPMAN, A. T., Phase studies in BeO–metal oxide systems, 17: 27833
CHAPNIN, V. A., Radiation defects in Li-doped Si, 17: 27927
CHARLEY, Philip J., Studies in regulation of intestinal Fe absorption, 17: 27040
CHARPAK, G., Developments of the discharge chamber, 17: 27705
CHASANOV, Martin G., Uranium solubility in Ga, In, Tl, and Pb, 17: 27394

CHATURVEDI, R. P., Decay of Ba-133, 17: 28267
CHAUDHRY, R., Cross sections for deuteron-induced fission, 17: 28314
CHEEVER, Paul R., Methods to determine Co-60 disintegration rate, 17: 27462
CHELTON, D. B., Solid formation in flowing cryogenic fluids, 17: 28084
CHENG, C. F., Chloride stress corrosion cracking of Ni–Cr–Fe alloys, 17: 27749 (KAPL-M-CC-3)
CHENG, Hung, Dynamical determination of the Regge pole parameters, 17: 28167
CHERKASOVA, L. S., Ionizing radiation and metabolism, 17: 27192
CHERNENKO, V. S., Possibility of strengthening steel in electron irradiation, 17: 27905
CHERNIKOV, N. A., Relativistic hydrodynamic equations from relativistic kinetic equation, 17: 27939 (JINR-P-1261)
CHERTKOVA, V. F., Radiation vulcanizing of elastomers, 17: 27485
CHEW, Geoffrey F., What is the nucleon?, 17: 28160 (UCRL-10842)
CHEZ, R. A., Gamma-emitting radionuclides in newborns, infants and children, 17: 27013 (TID-18878)
CHIOTTI, Primo, Separation of impurities from Th, 17: 28465 (TID-7650 (p.436-53))
CHIOTTI, Primo, Thermodynamic properties of CaH_2, 17: 27357
CHIRKINYAN, S. S., Photochemical behavior of uranin in liquid and solid solutions, 17: 27399
CHLECK, D., Kryptonates: Kr-85 becomes a universal tracer, 17: 27461
CHMUTOVA, M. K., Extraction of Pu, 17: 27305
CHOBA, G., X-ray-induced carcinoma simulating noma, 17: 27130
CHOPRA, V. L., Sprout inhibition in irradiated potatoes, 17: 27158
CHRISTENSEN, P. la Cour, Analog computer model dynamics of Halden-I reactor, 17: 28529 (KR-45)
CHRISTENSON, L. D., Radiation effects on stages of fruit fly species, 17: 27120
CHRISTIAN, John E., Determination of $CaCO_3$ moisture by radioisotope technique, 17: 27642
CHUPAKHIN, M. S., Determination of microimpurities in solid substances, 17: 27308
CHUPRINA, V. G., Crystalline structure of alloys in system Ni_3Al–Ni_3Nb, 17: 27828
CHUVILO, I. V., Production of strange particles by π^- mesons on Xe, 17: 28339
CHYSKY, Jaromir, Radiation protection in agriculture and agricultural research, 17: 27627
CICHOWLAS, Zofia, Changes in intestinal microflora in x-irradiated rats, 17: 27074
CIMA, Lorenzo, Increase in chemotherapeutic coefficient of mechlorethamine by action of Na DEDTC, 17: 27030
CIUDIN, M. Titus, Inelastic π^--nucleon interactions, 17: 28171
CLARK, G. M., Radiation. The cellular approach, 17: 27136
CLARK, M., Jr., Monoenergetic Boltzmann equation. I., 17: 28412
CLARK, M., Jr., Monoenergetic Boltzmann equation. II., 17: 28413
CLARK, R. G., Monitoring surface temperature of irradiated fuel elements, 17: 27652 (HW-SA-3036)
CLAYTON, C. G., Scattering of β particles by thick absorbers, 17: 28008
CLAYTON, Donald D., Abundances of U and Th, 17: 27575
CLINE, Carl F., Microhardness of single crystals of BeO, 17: 27343
CLINTON, S. D., Reactor irradiation of thoria powders and pellets, 17: 28477 (TID-7650(p.675-95))
CLINTON, S. D., Thorium fuel cycle irradiation program, 17: 28476 (TID-7650(p.643-74))
COCHINAL, Roland, Display device for cyclically checking a multiplicity of points, 17: 27679
COEN, V., Power excursion reactor, 17: 28563 (EUR-271.i)
COHEN, M., Depth dose tables for medium-energy x rays, 17: 27633
COHEN, R. L., High velocity drive for Mössbauer experiments, 17: 27665
COHEN, S., Equilibrium shapes of rotating charged drop and consequences for heavy-ion-induced nuclear reactions, 17: 28258 (UCRL-10775)
COHEN, Stanley, Deformation energy of a charged drop. V., 17: 28262
COLBY, John W., Inversion of pole figures for materials having orthorhombic symmetry, 17: 27791 (NLCO-862(Rev.4))
COLE, L. J., Inhibition of thymidine kinase–DNA polymerase activity in kidney by x radiation, 17: 27066 (USNRDL-TR-640)
COLE, M. P., Value of ovarian irradiation in management of breast cancer, 17: 27075
COLEBOURNE, N., Polymerization of acrylonitrile in N,N-dimethylformamide, 17: 27467
COLES, R. E., Permeability of Ag to O, 17: 27821
COLLI, L., Measurement of the $Si^{28}(n,\alpha)Mg^{25}$ reaction, 17: 28295
COLLINS, Michael A., Alpha-particle activity from tobacco, 17: 27622
COLLINS, William R., Jr., Prog. rpt. on fallout program, 17: 27592 (HASL-138)
COLLINSON, E., Polymerization of acrylonitrile in N,N-dimethylformamide, 17: 27467
COLLOT, Claude, Transformation of β phase in U–Nb, 17: 27824
COLOMBO, R. L., Steam sintering of UO_2 pellets, 17: 27740
COMAR, C. L., Fetal metabolism of Cs-137 in rat, 17: 27036
COMAR, C. L., Fluoridated water and skeletal uptake of Sr-85 and Ca-45 by young rats, 17: 27044
COMBRISSON, Jean, Improvements in devices for measuring magnetic fields, 17: 27678
COMMINS, E. D., Nuclear magnetic dipole moment of O-15, 17: 28311
COMPERE, E. L., In-pile testing of circulating thoria suspensions, 17: 28478 (TID-7650(p.696-720))
CONDAS, George A., Seebeck coefficient of CsAu, 17: 27872
CONN, P. K., Diffusion coefficients for H in beta Zr, 17: 27844
CONRAD, H., Deformation of b.c.c. metals, 17: 27879
CONSOLAZIO, C. Frank, Nutrition of 96 naval recruits during a shelter habitability study, 17: 27612
CONSTANT, R., Contamination of isotope laboratories, 17: 27614
CONSTANTINESCO, Anisoara, Inelastic π^--nucleon interactions, 17: 28171
CONTRACTOR, G. P., Properties of plain C steels containing U, 17: 27823
CONZETT, H. E., Inelastic scattering of 166-Mev O-16 ions by Ta-181, 17: 28259 (UCRL-10825)
CONZETT, H. E., Phase-shift analysis of heavy ion scattering, 17: 27949 (UCRL-10769)
COOK, K. G., Thermionic generator with ion injection, 17: 27982
COOPER, W. Clark, Case study No. 1: U milling and mining, 17: 27617
COPPAGE, F. N., Neutron effectiveness in producing photoconductivity in dielectric materials, 17: 27893 (TID-18843)
CORBEN, H. C., Boson eigenstates in generalized field theory, 17: 28153 (NP-12904)
CORDISCHI, D., Solid-state polymerization of phosphonitrilic chloride, 17: 27474
COREY, K. R., Strontium-85 and Ca-47 uptake by bone metastases, 17: 27019
CORK, Ann, Ultraviolet sensitivity of hamster cells, 17: 27168
CORNELIUS, E. B., Prog. rpt. on non-electrically conducting fine particulates, 3/61–9/62, 17: 27313 (ASD-TDR-62-843)
CORNISH, E. H., Ionization in cylinders irradiated with electrons, 17: 28009
CORNISH, J., Earth's radiation belts at 180-250 km, 17: 28127
CORNU, Ayme, Hydrocarbons from hydrolysis of mixtures of UC and UC_2, 17: 27409
COSTANZO, D. A., Polymerization, depolymerization, and precipitation of Pu(IV) as functions of temperature, 17: 27319 (ORNL-TM-585)
COTECCHIA, V., Natural tracing by seasonal variation of $^{18}O/^{16}O$ ratio in a ground water research, 17: 27565 (RT/GEO(63)-25)
COTLOVE, Ernest, Early effects of radiation on renal function, 17: 27077
COUCOULAS, A., Reactions between refractory oxides and graphite, 17: 27344
COVA, S., Amplitude distribution of photomultiplier response, 17: 27659
COVINGTON, A. E., Studies of ten solar active regions, 17: 28110
COX, F. M., Integral γ and neutron measurements on Kiwi-B-4A, 17: 28572 (LA-2885)
COX, Harry Albert, Moderator core structures for nuclear reactors, 17: 28519
COXE, E. F., Internal insulation for liquid-H-fueled missiles, 17: 28089
COYLE, James E., Radiation therapy of malignant disease, 17: 26989
CRAWFORD, C. G., Commercial γ-ray package sterilizing plant, 17: 27646
CRAWFORD, F. W., Electrostatic resonances of hollow plasmas, 17: 28374
CRAWFORD, Richard B., Anisotropy factors for total neutron yield from $D(d,n)He^3$ and $T(d,n)He^4$, 17: 28254 (UCRL-10752(Suppl.))
CREAGAN, R. J., How far can we go with PWRs?, 17: 28542
CREAMER, B., Arrest of intestinal epithelial turnover by x irradiation, 17: 27103
CREASY, Min, Recovery of γ-irradiated *Rhizopus stolonifer* sporangiospores,

17: 27118
CREEDON, J., Sources of positive ions for space charge neutralization, 17: 27984
CROCKER, G. R., Fission product yields of thermonuclear explosion, 17: 28260 (USNRDL-TR-642)
CROFT, J. F., Release of I-131 in Zenith containment, 17: 28418 (AEEW-R-172)
CRONVICH, J., Biologic half life of Mg-28 in the dog, 17: 27022
CROOKALL, J. O., Late effects of thorotrast in mice, 17: 26972
CROUSE, D. J., Thorium reserves in granitic rock, 17: 28450 (TID-7650 (p.29-56))
CROWLEY, Cathryn, Chromosome aberrations in liver cells, 17: 27176
CUCCHIARA, O., Kryptonates: Kr-85 becomes a universal tracer, 17: 27461
CUJEC, Bibijana, Structure studies in Pd isotopes, 17: 28315
CUNNINGHAM, Joseph, Formation and annealing of radicals in irradiated nitrates. III., 17: 27422 (TID-17105)
CURRIE, D. J., Polymerization of acrylonitrile in N,N-dimethylformamide, 17: 27467
CURTIS, Howard, Chromosome aberrations in liver cells, 17: 27176
CURTIS, R. W., Thermodynamic properties of CaH_2, 17: 27357
CURZON, F. L., TE_{0mn} modes of a quasi-co-axial resonant cavity, 17: 28373
CZEMPIEL, Heinz, Therapy of malignant thyroid tumors, 17: 26966

D

DAANE, A. H., Scandium–Y and Sc–Zr system, 17: 27785 (IS-569)
DAANE, A. H., Welding Ta for high-temperature applications, 17: 27768
DACQUINO, T., Gamma encephalography in diagnosis of cerebral lesions, 17: 26997
DAINTON, F. S., Polymerization of acrylonitrile in N,N-dimethylformamide, 17: 27467
DALGARNO, A., Electron temperatures in ionosphere, 17: 28115
DALY, G. J., Migration of Cs on Re and W, 17: 27971
DALY, N. R., Mass spectrometry of solids, 17: 27278
DAMBURG, R., Cross sections for H excitation by electrons, 17: 28067
DAMMONT, F. R., Irradiation of polyethylene oxide and polypropylene, 17: 27914
DANFORTH, John P., Method for determining fluid flow in a conduit, 17: 27680
DANILOV, G. S., Neutron-deuteron doublet scattering length, 17: 28210
DARRAS, R., Analysis of O in Na, 17: 27245 (AEC-tr-5840)
DARVAS, Janos, Alpha spectrum from decay of Li-8, 17: 28331
DASGUPTA, H. C., Thiocyanates of alkaline-earth metals, 17: 27332
DA SILVEIRA, Rui, Nuclear spallation reactions, 17: 28268
DA VEIGA, L. M. d'Alte, Structure of σ-phase Co_2Mo_3, 17: 27818
DAVID, Harold, X-irradiation of lung and posterior mediastinum. IV., 17: 27127
DAVIDSON, Edwin H., Calculating U-235 outputs and charges, 17: 27713 (TID-8539)
DAVIDSON, J. K., PCUT—program for recycle of power reactor fuel, 17: 28461 (TID-7650(p.285-332))
DAVIES, D., Release of inert gases from UO_2, 17: 27886 (AERE-M-969)
DAVIES, J. A., Range of Xe-133 and Ar-41 ions in Al, 17: 28001
DAVIES, J. A., Range of inert gas ions in metals, 17: 28002
DAVIES, J. A., Use of α spectroscopy for studying anodic oxidation, 17: 27753
DAVIES, T. V., Magnetohydrodynamic boundary layer. I., 17: 27554
DAVIES, T. V., Magnetohydrodynamic boundary layer. III., 17: 27556
DAVIS, F. W., Kilorod facility, ORNL, 17: 28463 (TID-7650(p.351-83))
DAVIS, Harold L., How big will power plants get?, 17: 28541
DAVIS, J. J., Radioecological studies of northern Alaska, 17: 27053 (HW-SA-3050)
DAVIS, R. L., Inducer-impeller for liquid H, 17: 28093
DAVIS, Sumner P., Nuclear moments of Hg-195, Hg-195m, and Hg-194, 17: 28284
DAYTON, Russell W., Prog. rpt. on civilian applications, 4/63, 17: 26944 (BMI-1630(Del.))
DEAN, J. W., Solid formation in flowing cryogenic fluids, 17: 28084
DEAN, J. W., Thermal conductivity of solid H_2O and D_2O, 17: 28082
DEAN, John A., Dialkyl phosphorodithioic acids in liquid extraction systems, 17: 27407
DEAN, O. C., Sol gel process for preparation of thoria-base fuels, 17: 28469 (TID-7650(p.519-42))
DEB, S. K., Photoelectric properties of the alkali metal azides, 17: 27468
DEBEAUVAIS-WACK, Monique, Sensitivity of ionographic emulsions, 17: 28168
DEBETS, P. C., X-ray-diffraction data on hydrated U peroxide, 17: 27352
DE BOER, P. C. T., Curvature of shock fronts in shock tubes, 17: 28038
DE BOISDEFFRE, Paul Fernet, Uranium oxide (UO_3), 17: 27737
DE BORTOLI, M., Measurements of ambient radioactivity—Ispra 1961, 17: 27591 (EUR-223.i)
DE BOSKEY, W. R., Irradiation testing of thoria–urania fuel, 17: 28475 (TID-7650(p.630-42))
DE CARLI, Felice, University of Rome activities during 1960–62, 17: 27755
DE CHAZAL, L. E. M., Dissolution rates of UO_2 sintered pellets in HNO_3 systems, 17: 27338
DEEM, H. W., Specific heat and heat of fusion of K, 17: 27792 (NP-12933)
DEERING, R. A., Effects of uv light on thymidine dinucleotide, 17: 27079
DEEVEY, Edward S., Radiocarbon. V., 17: 27581
DEGEILH, Andre, Faults created in solids. III., 17: 27906
DEJONGHE, P., Radioelements in soil at Mol, 17: 27602 (EURAEC-416)
DEJONGHE, P., Treatment and storage of radioactive wastes, 17: 28579 (EURAEC-295)
DEKA, G. C., Hammer stars caused by Li-9—decay, 17: 28274
DE LA GARZA, A., Variable key weight cascade for multicomponent isotope separation, 17: 27712 (K-1571)
DELATTRE, P., Activities of EURATOM dosimetry working group, 17: 27590 (EUR-88.f)
DE LISLE NICHOLS, John Winfrith, Testing for the presence of a component in liquors, 17: 27222
DELL, Friedrich, Radiation effects on cellulose and plant structural substances, 17: 27088
DEL MARMOL, P., Decay of Zn-72, 17: 28281
DE MAIO, G., Pulmonary metastases from thyroid carcinoma, 17: 26998
DE MASTRY, J. A., Engineering properties of Th–U compounds, 17: 28466 (TID-7650(p.454-67))
DEMIDENKO, Z. A., Inelastic scattering of neutrons in NaCl, 17: 27392
DEMIDOV, A. M., Levels of Sm-150 excited in (n,γ) reaction, 17: 28305
DENISOV, S. P., Photoproduction of π^0 mesons on protons, 17: 28204
DENNO, William, Mössbauer cross section for Fe-57, 17: 28248 (TID-18899)
DENNY, John P., Melting and casting Be, 17: 27765
DEPIEDS, R., Preparation of I^{131}-labeled insulin, 17: 27032
DEPTUCH, Wlodyslow, Present status of medical radiology and protection against ionizing radiations, 17: 27626
DERRICK, G. H., Annihilation operators in the space of periodic functions, 17: 28180
DESER, S., Note on uniqueness of canonical commutation relations, 17: 28023
DE SILVA, Alan W., Hydromagnetic wave propagation near ion cyclotron resonance, 17: 28391
DESOV, A. E., Technology of heavy concretes for protection against radioactivity effects, 17: 27930
DE SPIEGELEER, W., Determination of Fe, Ni, and Cr traces in polyphenyls, 17: 27227 (EUR-28.f)
DE SPIEGELEER, W., Determination of Ba, Nb, Sr, Fe, Mn, and Zn in carbonatites, 17: 27228 (EUR-32.f)
DESREUX, V., Vinyl acetate polymerization by γ radiation, 17: 27471
DESSLER, A. J., Interpretation of K_p geomagnetic storms, 17: 28116
DESSLER, A. J., Termination of solar wind and solar magnetic field, 17: 28111
DE STEIGUER, Don, Tritium for determination of estrogen in tissues of broilers fed 3,4-dianisyl-2-*t*-3-hexene, 17: 27050
DEVANATHAN, V., Scattering of charged pions by deuterons, 17: 28185
DEVIN, B., Thermoemissive properties of UC, 17: 27978
DEVLIN, Robert L., Control of ionizing radiation in Massachusetts industry, 17: 27615
DEWEY, W. C., Survival of irradiated mammalian cells, 17: 27152
DEWEY, William C., Ultraviolet sensitivity of hamster cells, 17: 27168
DEY, Arun K., Chelate formation between Th(IV) and sulfodichlorohydroxydimethylfuchson dicarboxylic acid, 17: 27214
DIACU, L., Influence of P-32 on tadpoles of *Rana temporaria*, 17: 27072

DIAMOND, R. M., Coulomb excitation of Tb-159, Ho-165, and Tm-169 with O-16 ions, 17: 28299
DIAMOND, R. M., Metastable states in Tl isotopes produced in heavy-ion reactions, 17: 28255 (UCRL-10764)
DICKERSON, R. F., Engineering properties of Th–U compounds, 17: 28466 (TID-7650(p.454-67))
DICKERSON, R. F., Thorium–U and Th–U base alloys for breeder applications, 17: 28467 (TID-7650(p.468-97))
DICKERSON, Ronald F., Prog. rpt. on civilian applications, 4/63, 17: 26944 (BMI-1630(Del.))
DIENSTBIER, Z., Hematological changes in radiation sickness. IV., 17: 27202
DIENSTBIER, Z., Radiation effects on erythrocytes, 17: 27166
DIENSTBIER, Zdenek, Urinary excretion of P-32 in rats following irradiation, 17: 27037
DIETHELM, L., Influence of weak preirradiation on effects of strong dose of radiation, 17: 27137
DIEU, H. A., Vinyl acetate polymerization by γ radiation, 17: 27471
DILLI, S., ESR of irradiated carbohydrates, 17: 27454
DILLON, R. L., Erosion-corrosion of Al alloys, 17: 27747 (HW-74359(Rev.))
DINHOFER, Alvin D., Localized mode detection by means of the Mössbauer effect, 17: 27375
DISSELHORST, B. F., Pore structure of graphite as affected by impregnation processes, 17: 27782 (GA-3194)
DIXON, C. E., Electron irradiation of ordered Cu_3Au, 17: 27892 (NAA-SR-Memo-504)
DIXON, Frank J., Antibody formation by whole-body x radiation, 17: 27121
DOBBS, H. E., General labeling of wool with I-131, 17: 27216
DODD, John Alan, Organic liquid moderated and cooled reactors, 17: 28508
DODSON, M. H., Isotopic analysis by surface ionization. I., 17: 27279
DOENAU, F., Isomerism of In-116, 17: 28310
DOERR, Eduardo, Endoscopy and endophotography with Debray-Segal rectoscope, 17: 27183
DOICH, R. V., Magnetoacoustic and shock waves in relativistic hydrodynamics, 17: 28066
DOLDON, R., Fatigue of Mg–Zr and Mg–Al canning materials, 17: 27847
DOLIN, P. I., Method of competitive scavenger in radiation chemistry, 17: 27177
DOLIQUE, Jean-Michel, Penetration of neutralized ion-electron beam, 17: 28370
DOLIQUE, Jean-Michel, Penetration of neutralized ion-electron beam, 17: 28372
DOLPHIN, G. W., Aspects of radiostrontium dosimetry, 17: 27165
DOLPHIN, G. W., Metabolism of Sr in adult humans, 17: 27049
DOMEIJ, B., Use of α spectroscopy for studying anodic oxidation, 17: 27753
DOMINICI, G., Measurements of ambient radioactivity—Ispra 1961, 17: 27591 (EUR-223.i)
DONDI, G., Power excursion reactor, 17: 28563 (EUR-271.i)
DONLAN, Vincent L., Proton hazard in space, 17: 27596 (NP-12905)
DONN, S. G., Reaction of H with Zr–Ti alloy, 17: 27347
DONOVAN, J. J., Prog. rpt. on non-electrically conducting fine particulates, 3/61–9/62, 17: 27313 (ASD-TDR-62-843)
DORF, R. C., Descriptors for two-phase automatic data retrieval system, 17: 27724 (TID-18886)
DORN, John E., Impact of dislocation theory on engineering, 17: 27810 (UCRL-10788)
DORSEY, Harry N., X-ray procedure brings less radiation exposure for patients, 17: 27610
DOUGLAS, F. W., Radiostrontium removal from milk, 17: 27038
DOUGLASS, D. L., Prog. rpt. on Zr alloy design, 7–9/62, 17: 27728 (GEAP-4076)
DOULAT, Jacques, Improvements in low-temperature irradiation, 17: 28570
DOVE, R. B., Helium-3 cryostat for oriented nuclei experiments, 17: 28092
DOYLE, William T., Structure of the F center in NaF, 17: 27376
DRAGOS, Lazare, Flow of conducting gas, 17: 28371
DRAPER, James, Focusing and transmission of quadrupole lens systems, 17: 28057
DRELL, S. D., Infrared radiation from high-altitude explosion x rays, 17: 27573
DRESSER, J. C., Stress detection by infrared inspection, 17: 27508 (SCTM-59-63(25))
DREYFUS, Gaspard Paul, Sealing and centering device for rotary shaft, 17: 27523
DRIVEN, S. M., Design of nuclear power plant with separate superheated steam reactors, 17: 28549
DROZDETSKAYA, G. V., Kinetics of dispersion of some refractory materials, 17: 27873
DRUSCHEL, R. E., Capture/fission ratio of U-233 for epithermal neutrons, 17: 28309
DU BOSE, C. K. H., Pyrolytic-carbon coated and uncoated uranium carbide particles, 17: 27796 (ORNL-TM-521)
DUCLOS, J., Scattering of 14-Mev neutrons from C-12, 17: 28301
DUFLO, J., Analysis of O in Na, 17: 27245 (AEC-tr-5840)
DUFLO, Marcelle, Gamma effects on Fe thiocyanate solutions, 17: 27440
DUMITRESCU, V., Methane radiolysis in an atomic reactor, 17: 27479
DUNNING, Gordon M., Foods and fallout, 17: 27606
DURNEY, B., Conductivity of slightly ionized gas, 17: 28040
DUTREIX, J., Fractionation of doses in radiotherapy, 17: 27145
DUTTA, A. K., Nuclear binding energy, 17: 28273
DUVIVIER, Charles, Resistance of synthetic paints to irradiation, 17: 27752
DWYER, O. E., High-temperature liquid-metal technology, Vol. 1, No. 2, 17: 27535 (BNL-801)
DYSON, Freeman J., Energy levels of complex systems. IV., 17: 28282
DYSON, Freeman J., Energy levels of complex systems. V., 17: 28283
DZYUB, I. P., Theory of Mössbauer effect on impurity nuclei, 17: 28340

E

EAKINS, J. D., Preparation of Te metal, 17: 27739
EDGAR, C. B., Jr., Prog. rpt. on two-phase flow and boiling heat transfer, 4/63, 17: 27543 (NYO-10486)
EDLUND, M. C., Future of thermal breeders, 17: 28545
EDLUND, M. C., Thorium fuel cycle economics, 17: 28479 (TID-7650 (p.721-37))
EDMONDSON, L. F., Radiostrontium removal from milk, 17: 27038
EELES, W. T., X-ray determination of atomic positions in alpha U, 17: 27819
EGELAND, A., Effects of nuclear explosions on vlf propagation, 17: 26954
EGGEN, D. T., Epithermal Th reactors, 17: 28455 (TID-7650(p.148-71))
EGLI, Paul H., Symposium on thermionic power conversion, Colorado Springs, 1962, 17: 27954
EICHELBERGER, J. F., Phase equilibria for NaF–BeF_2–UF_4, 17: 27336
EIKENBERRY, H. M., Electron beam melting of U, 17: 27732 (NLCO-881)
EISEN, F. H., Cryostats for irradiating at 4.2°K, 17: 28091
EISENBERG, J. M., Isospin selection rules for high-energy electron scattering, 17: 28326
EISMONT, V. P., Fission of U and Th by sub-barrier deuterons, 17: 28337
EKERT, Bernard, Self-decomposition of tritiated thymidine, 17: 27443
ELBEK, B., Coulomb excitation of Tb-159, Ho-165, and Tm-169 with O-16 ions, 17: 28299
ELCOMBE, A. D., Uranium carbide as thermionic emitter, 17: 27969
ELDRIDGE, E. A., Specific heat and heat of fusion of K, 17: 27792 (NP-12933)
ELLARD, J. A., Prog. rpt. on organic coolants, 1–3/63, 17: 28433 (IDO-11005)
ELLEMAN, Thomas S., Fission-fragment-induced stresses in ceramic materials, 17: 27888 (BMI-1635)
ELLENFSEN, Paul R., Precipitation with N-benzoylphenylhydroxylamine acetate, 17: 27299
ELLETT, W. H., Medical use of reactors, 17: 27162
ELLINGER, F. H., Crystal structure of alpha Pu metal, 17: 27787 (LADC-5523)
ELSTON, J., Collection of He in sintering of BeO, 17: 27912
ELVING, Philip J., Coulometric determination of Tc, 17: 27249
ELVING, Philip J., Determination of small amounts of Zr. I., 17: 27298
ELVING, Philip J., Liquid-liquid extraction of pertechnetate ion, 17: 27494
ELWELL, W. T., Determination of B in Zr, Hf, and Ti, 17: 27265
ELY, Robert P., Beta-decay branching ratio of the λ hyperon, 17: 28192
EMERSON, David Colin, Improvements in fuel element assemblies, 17: 28509
EMERSON, L. C., Bremsstrahlung from electron-bombarded thin Au foils,

17: 28313
EMMETT, M. B., CDC-1604 subroutine package for making linear, logarithmic, and semilogarithmic graphs, 17: 27723 (ORNL-3447)
ENDO, Michio, Versatile Co-60 irradiation facility, 17: 27513
ENDREI, E., Surgical-radiological treatment of lung carcinomas, 17: 27007
ENG, K. Y., Determination of C in Na, 17: 27317 (NAA-SR-7918)
ENGELDER, T. C., Thermal activation method for ρ_{in} measurements in enriched UO_2 lattices, 17: 28419 (BAW-1268)
ENGFELDT, Bengt, Effect of Sr intake on rats, 17: 27018
ENGLEBERT, S. L., Pre-irradiation metallography on NAA 47 fuels, 17: 27790 (NAA-SR-Memo-8408)
ENGLEHEART, William Paul, Improvements in nuclear reactors, 17: 28515
ENGLISH, J. J., Binary and ternary phase diagrams of Nb, Mo, Ta, and W, 17: 27778 (DMIC-183)
ENO, B. E., Fuel element temperature lag during power transients, 17: 28438 (KAPL-M-BEE-1)
ENOMOTO, Saburo, Enrichment of D_2O by exchange, 17: 27388
ENOMOTO, Shigemasa, Nondispersive x-ray spectrochemical analysis, 17: 27280
EPSTEIN, Leo F., Liquid metal studies in France and Great Britain, 17: 27731 (NASA-TM-X-884)
ERDELYVARI, Istvan, Soft γ absorption meter for radiation safety measurements, 17: 27698
ERMISCHER, W., Uranium oxide formation heats, 17: 27364
ERNST, Hanna, Radioinduced nucleoprotein decreased in cell nuclei, 17: 27157
ERNST, W. S., Jr., Vibratory-compaction studies on thoria–uranias, 17: 28472 (TID-7650(p.585-605))
ERSHOV, B. G., EPR spectrum of a hydrated electron, 17: 27435
ERTAUD, Andre, Sealing and centering device for rotary shaft, 17: 27523
ETO, Hideo, Radiosensitivity and thyroid function in mice, 17: 27173
ETTER, H., Oscillating irradiation with progredient filtering, 17: 27008
ETTER, H., Volume dose in Co-60 therapy, 17: 27009
EVANS, J. E., Spin-parity combinations for levels in Mg-24 and Si-28, 17: 28324
EVANS-LUTTERODT, K. O., Simulation of pool boiling heat transfer, 17: 27550
EVE, I. S., Aspects of radiostrontium dosimetry, 17: 27165
EVE, I. S., Metabolism of Sr in adult humans, 17: 27049
EWERTSON, Goeran, Chimerical structure of somatic Solanum mutant revealed by irradiation, 17: 27100
EZRAN, S., Uranium oxide sintering with view to increasing thermal conductivity, 17: 27814 (EURAEC-103)

F

FAIRBAIRN, A., Classification of radionuclides for transport purposes, 17: 27586 (AHSB(RP)R-23)
FAIRFIELD, Donald H., Ionosphere current patterns in high latitudes, 17: 28019
FAIVRE, Rene, Transformation of β phase in U–Nb, 17: 27824
FALCONER, D. S., Test for sex-linked lethals in irradiated mice, 17: 27098
FALCONER, John W., Radiolysis of liquid aliphatic hydrocarbons, 17: 27455
FALICOV, L. M., Magnetic breakdown in Mg, 17: 27870
FARELLO, Giovanni Elvio, Testing of equipment and mechanical components, 17: 28488
FARHATAZIZ, Radiolysis of K dichromate in acid solution, 17: 27466
FARKAS, M. S., Thorium–U and Th–U base alloys for breeder applications, 17: 28467 (TID-7650(p.468-97))
FARLEY, T. A., Earth's outer radiation belt, 17: 28055
FASCIA, J. R., Aqueous corrosion of Zr single crystals, 17: 27748 (KAPL-2257)
FAUGERAS, Pierre, Preparation of U compounds, 17: 27403
FAULKNER, E. A., Electron spin resonance in irradiated diamond, 17: 27918
FAULKNER, Rofford L., Uranium, 17: 26953
FAUSTOV, R. N., Quasioptical potential in model of quantum field theory, 17: 28146 (JINR-P-1253)
FAWCETT, Sydney, Joints between tubes of dissimilar materials, 17: 27529
FAY, James A., Magnetohydrodynamics of partially ionized gases, 17: 27540 (NP-12767(p.65-7))
FEBER, R. C., Heats of dissociation of gaseous chlorides, 17: 27315 (LA-2841)
FEDERBUSH, P. G., Scattering amplitudes in perturbation theory. I., 17: 28164
FEDERBUSH, P. G., Scattering amplitudes in perturbation theory. II., 17: 28166
FEDERIGHI, F. D., SWAK—thermal cross section program, 17: 28243 (KAPL-M-RPC-6)
FEDOSEEVA, T. S., Radiation vulcanizing of elastomers, 17: 27485
FEJER, J. A., Interpretation of K_p geomagnetic storms, 17: 28116
FELDMAN, H. R., Nuclear magnetic dipole moment of O-15, 17: 28311
FELICI, N., Electrostatic generators in nuclear physics, 17: 27661
FELTHAM, P., Stress relaxation and dynamic recovery in Co, 17: 27867
FEOFILOV, P. P., Absorption and luminescence of divalent Sm, 17: 27372
FERGUSON, E., Stark broadening of Balmer lines, 17: 27992
FERNANDEZ, A., Monocrystals of Tl-activated KI, 17: 28056
FERREIRA, Emma Perez, Interactions $\pi^- + C$ at 915 Mev. I., 17: 28199
FERRERO, Giorgio M., Motion of viscous fluid, incompressible current, 17: 28368
FERRIS, L. M., Aqueous processing of Th fuels, 17: 28464 (TID-7650 (p.384-435))
FERRO-LUZZI, Massimiliano, Properties of ω meson from $K^- + p \rightarrow \Lambda + \omega$, 17: 28159 (UCRL-10723)
FERRON, Pierre, Absorption of radioactive Cs by barley, 17: 27031
FERRY, C. V., Wetting of solids by liquid H, 17: 28083
FERZIGER, Joel H., Energy dependent neutron transport theory. I., 17: 28229
FESSENDEN, Richard W., Energy transfer in ethane–ethylene mixtures, 17: 27406 (RRL-113)
FETTWEIS, P. F., Decay of Zn-72, 17: 28281
FICKETT, Wildon, Detonation properties of condensed explosives, 17: 27374
FIEGEL, L. J., Prog. rpt. on refractory metal oxides, final, 6/61–6/63, 17: 27788 (LRR-41)
FIKE, H. R., Bucklings and void effects in heavy water lattices, 17: 28134
FINCKH, E., Photoprotons from N-15, 17: 28294
FINK, R. W., L/K-capture ratio in Mn-54, Fe-55, Co-57, and Co-58 decays, 17: 28325
FINLAYSON, M. J., Reduction of uranyl carbonate to UO_2, 17: 27339
FIRKOWSKI, R., High energy-photon-initiated E.A.S., 17: 28119 (PAN-382/VI)
FISCHER, H., Peroxide radicals in irradiated polypropylene, 17: 27450
FISENNE, Isabel M., Radium-226 in human diet, 17: 27051
FISHER, D. A., Thyroidal I-131 uptake rate in infants, 17: 27020
FISHER, Hymen, Chronic internal irradiation in humans, 17: 27150
FISHER, P. A., Metallurgically stable Mg–Zr alloys, 17: 27848
FITCHEN, D. B., Four-window cell and cryostat, 17: 27666
FLAVIN, R. K., Collision probability of electrons with Cs atoms, 17: 27955
FLEISCHER, R. L., Ternary fission of heavy compound nuclei, 17: 28257 (UCRL-10772)
FLEISCHER, R. L., Tracks of charged particles in high polymers, 17: 27925
FLEMING, J. D., Prog. rpt. on materials for high-temperature nuclear application, 1–4/63, 17: 27807 (TID-18891)
FLEMMING, Kurt, Effective mechanism of serotonin as radiation protector, 17: 27154
FLEMMING, Kurt, Radioprotective effect of ethyl stearate, 17: 27156
FLETCHER, J. L., KARE input, Rev. V., 17: 27721 (KAPL-M-JA-6)
FLETCHER, W. D., Ion exchange in boric acid solutions with radioactive decay, 17: 27493 (WCAP-3716)
FLINT, Richard Foster, Radiocarbon. V., 17: 27581
FLODMARK, Stig, Zirconium–O system, 17: 27817
FODOR, E., Effect of N on isotopic exchange between H and water vapor, 17: 27326
FOGGI, C., Power excursion reactor, 17: 28563 (EUR-271.i)
FOKIN, A. V., Polymerization of vinylidene fluoride under γ irradiation, 17: 27470
FOMICHENKO, K. V., Ionizing radiation and metabolism, 17: 27192

FOMIN, P. I., Asymptotic value of vertex function, 17: 28216
FOMON, John J., X-irradiation of lung and posterior mediastinum. IV., 17: 27127
FOREST, A. E., Elastic scattering of deuterons by V, 17: 28306
FORMAN, Peter R., Hydromagnetic wave propagation near ion cyclotron resonance, 17: 28391
FORMAN, R., Space charge neutralization in thermionic diodes, 17: 27986
FORSYTH, J. B., Structure of σ-phase Co_xMo_y, 17: 27818
FORTIN, Antoine, Pivot mountings for remote controls, 17: 27522
FORTIN, Marcel, Pivot mountings for remote controls, 17: 27522
FOWLER, Richard G., Electrically energized shock tubes, 17: 28402
FOX, Marvin, Performance of auxiliary discharge thermionic energy converters, 17: 27983
FRAGA, A. Rodriguez, Lead-212 in atmosphere of Mexico City, 17: 27628
FRANK, L. A., Charged-particle observations in outer magnetosphere, 17: 28123
FRANKEL, Howard H., Rat reticuloendothelial system and endocrine gland responses to foreign particles, 17: 26967
FRANKEVICH, E. L., Relaxation polarization in saturated hydrocarbons, 17: 27469
FRASER, D. A., Thermionic generator with ion injection, 17: 27982
FREDERKING, T. H. K., Nucleate boiling of liquefied gases, 17: 28094
FREDKIN, Donald R., Proper self-energy function in many-particle systems, 17: 28178
FREDRICKSON, Paul B., Prog. rpt. on radiological mechanisms for geophysical research, annual, 1962, 17: 27564 (NYO-10219)
FREEMAN, S. M., Foams and plastic films for insulation systems, 17: 28090
FREEMAN, S. M., Internal insulation for liquid-H-fueled missiles, 17: 28089
FREER, John, Reactor control rod winding mechanisms, 17: 28513
FREYHEIT, Paul, Prog. rpt. on fast wave plasma amplifier, 11/20/62, 17: 28357 (AD-290086)
FRIBERG, Jean, Sealing and centering device for rotary shaft, 17: 27523
FRIDRICH, R., Surgical-radiological treatment of lung carcinomas, 17: 27007
FRIEDMAN, A. M., Alpha decay of Cf-246, 17: 28318
FRIEMAN, Edward A., Dynamics of gases and plasmas, 17: 27539 (NP-12767(p.10-12))
FRIPPIAT, J., Gamma radiation curves for steel, Al, U, 17: 27889 (EUR-103.f)
FRISCHKORN, Rolf, Exclusive percutaneous irradiation of cervical carcinoma by telecobalt, 17: 26976
FROLOV, G. V., Asymptotic relations for scattering, 17: 28218
FROLOV, G. V., Fermion Regge poles in electrodynamics, 17: 28217
FROMM, Jacob E., Problem of vortex street development, 17: 27553
FROMMHOLD, L., Production of uv light pulses, 17: 27671
FRONTEROTTA, G., Absorption of π^- mesons in complex nuclei, 17: 28139 (ISS-63/28(p.1-11))
FUCHS, G., Carcinogenesis by x and γ rays, 17: 27187
FUCHS, N. H., Behavior of scattering amplitudes in perturbation theory, 17: 28176
FUJII, A., Unitary symmetry model for photoproduction, 17: 28149 (LNF-63/21)
FUJIOKA, Manabu, Experiment on $O^{18}(p,\gamma)F^{19}$ reaction, 17: 28290
FUJIWARA, Shiro, Refractive indices of CeO_2–CF, films, 17: 27355
FUJIWARA, Toshihiko, Fetal disturbances due to radiation, 17: 27106
FUKUDA, Michiko, Deuterium separation factor on Pt, 17: 27717
FULLER, D. D., Prog. rpt. on gas-lubricated bearings, 12/62–2/63, 17: 27510 (TID-18924)
FUNKE, L., Decay of 27-hour Ho-166, 17: 28291
FURUSAWA, Akira, Irradiation hardening of Cu, 17: 27913

G

GABOR, D., Gas discharges with extraneous ion supply, 17: 27980
GAFFEY, William R., Cancer therapy—evaluation of supervoltage x ray, 17: 26973
GAGLIONE, P., Measurements of ambient radioactivity—Ispra 1961, 17: 27591 (EUR-223.i)
GAILITIS, M., Cross sections for H excitation by electrons, 17: 28067
GAINES, E. E., Radiation effects on photographic materials, 17: 27924
GAJEWSKI, Ryszard, Hydromagnetic waves in inhomogeneous magnetic fields, 17: 27995
GALASSO, Francis, Superconducting alloys of the $Nb_3Sn_xM_{1-x}$ type, 17: 27861
GALE, Alfred J., Apparatus for carrying on nuclear reactions, 17: 28406
GALL, Ruth, Motion of charged particles in slowly varying fields, 17: 28017
GALLAGHER, Anne, Formation of 1,5,7,11-tetrathiaspiro[5.5]-undecane, 17: 27412
GALLEY, Robert, Sealing and centering device for rotary shaft, 17: 27523
GAMBINO, J. R., Yttrium and rare earth vanadates, 17: 27217
GAMBOA LOYARTE, J. M., Application of radioisotopes to agriculture, 17: 27092
GANDINO, G., Measurements of ambient radioactivity—Ispra 1961, 17: 27591 (EUR-223.i)
GANNO, Shigetake, Enzyme inactivation by γ radiation, 17: 27430
GANNO, Shigetake, Radiation sensitivity of amino acids, 17: 27429
GANNO, Shigetake, Radiation effects on color of pearl, 17: 27901
GARBER, E. D., Parasexual cycle in *Aspergillus fumigatus*, 17: 26978
GARCIA, A., Elastic scattering of deuterons by V, 17: 28306
GARCIA, E. E., Analysis of Pu and U compound mixtures, 17: 27256
GARD, E., Methane radiolysis in an atomic reactor, 17: 27479
GARDNER, E. L., Identification of real and spurious scrams, 17: 28442 (NAA-SR-Memo-6688)
GARDNER, L. E., Catalysts for selective hydrocracking of polyphenyls, 17: 28434 (IDO-16858)
GARDNER, L. E., Catalytic hydrocracking of high boiler in reactor coolant, 17: 28435 (IDO-16877)
GARDNER, R. D., Determination of traces of nitride N in Na, 17: 27232 (LA-2892)
GARNETT, J. L., ESR of irradiated carbohydrates, 17: 27454
GARRATT, P. G., Radiation protection by S in a model system, 17: 27438
GARY, John, Implicit finite difference schemes for hyperbolic systems, 17: 27722 (NYO-10426)
GASKELL, Brian Vernon, Improvements in nuclear reactor fuel elements, 17: 28503
GASPARINI, P., Localization of radioactive Pb in bone, 17: 27016
GATTO, R., Determining spin of Ξ, 17: 28150 (LNF-63/31)
GAWIN, J., High energy-photon-initiated E.A.S., 17: 28119 (PAN-382/VI)
GAYTE, G., Thermoemissive properties of UC, 17: 27978
GEBAUER, Helwig, New types of halogen counters, 17: 27690
GEHMAN, B. L., Low-work-function collectors, 17: 27972
GEILER, Kenneth L., Discharge in operating electron bombardment engine, 17: 28360 (JPL-TR-32-417)
GEIST, J. M., Closed-cycle cascade He refrigerator, 17: 28079
GELEZUNAS, V. L., Diffusion coefficients for H in beta Zr, 17: 27844
GELIN, Ragnar, How Sweden is developing its low-grade U_3O_8, 17: 27489
GENAUD, P., Man and radiation, 17: 27151
GENNARI, C., Intestinal absorption of Ca-45 in senile osteoporosis, 17: 27017
GENTILE, Antonio, Interactions $\pi^- + C$ at 915 Mev. I., 17: 28199
GERHART, F. James, 1-Deuteriopentaborane rearrangement, 17: 27410
GETHARD, P. E., Fission-product release from UC_2 particles, 17: 27784 (GA-4267)
GETOFF, N., Separation of I from Te, 17: 27495
GHERBANOVSKI, Cleopatra, Inelastic π^--nucleon interactions, 17: 28171
GHORMLEY, J. A., Space charge neutralization in thermionic diodes, 17: 27986
GHYS, R., Irradiator especially adapted for biological research, 17: 27116
GHYS, Roger, Influence of metabolic factors on radiosensitivity, 17: 27209
GIDAL, George, Beta-decay branching ratio of the λ hyperon, 17: 28192
GIEDT, R. R., Recombination rates in a shock tube, 17: 27373
GIGNOUX, H., Preparation of I^{131}-labeled insulin, 17: 27032
GIL, G. Cocho, Resonance model in nucleon-antinucleon annihilation, 17: 28197
GILBODY, H. B., Charge transfer and ionization by positive ions, 17: 28054
GILES, R. A., Scintillation of liquid Ar, 17: 28059
GILL, P., Refractive indices of gases in vacuum ultraviolet. II., 17: 28029
GILLESPIE, A. S., Jr., Prog. rpt. on double decomposition radio release analysis for Ca and phosphate ions. Final, 1962, 17: 27233 (ORO-588)
GILLILAND, Ralph Gerald, Wettability of metals and alloys on Be,

17: 27795 (ORNL-3438)
GILTINAN, D. A., Nonlocal nucleon-nucleon interaction, 17: 28187
GINIBRE, Jean, Wigner–Eckart Theorem and simple Lie groups, 17: 28182
GIORDANI, R., Indicator methodology for diagnosis of tumors by means of radioisotopes, 17: 26992
GIRSKAYA, E. (Ye.) Ye., Hygienic significance of natural radioactivity in mining, 17: 27603 (JPRS-19866)
GIUBILEO, M., Fluorine in urine of general population and exposed workman, 17: 27589 (CNI-111)
GIVENS, W. W., First and second excited levels of Ne-19, 17: 28298
GIZA, Tadeusz, Leukemia, 17: 27210
GLASS, Laurel E., Development of x-irradiated mouse oocytes, 17: 27117
GLAVIN, G. G., Determination of microimpurities in solid substances, 17: 27308
GLAZOV, N. V., Use of radioactive isotopes in engineering studies, 17: 27583
GLAZUNOV, P. Ya., EPR spectrum of a hydrated electron, 17: 27435
GLEIT, Chester E., Iron content of stainless steel microspheres, 17: 27253
GLEMOBITSKII, Ya. L., Effects of cosmic flight factors on certain biological indices in insects, 17: 27200
GLINOS, Andre D., Serum after whole-body x irradiation, 17: 27171
GLOWER, D. D., Radiation effects on lead zirconate titanate ferroelectrics, 17: 27894 (TID-18856)
GODA, Shiro, Separation of Sc from Y, 17: 27369
GOEBEL, Jack B., Computer programs for indexing x-ray diffraction powder patterns. I., 17: 27720 (HW-SA-2756)
GOEING, H., Inelastic proton scattering on complex nuclei, 17: 28304
GOLACKA, Krystyna, Myeloid leukemia following x irradiation, 17: 27167
GOLAN, S., Balanced nuclear economy, 17: 28546
GOLD, V., Deuterium oxide and its mixtures with H_2O, 17: 27379
GOLD, V., Fractionation of H isotopes between H ions and H_2O, 17: 27380
GOLDANSKII, V. I., Radiation polymerization of acetylene hydrocarbons, 17: 27477
GOLDBERG, Murray D., Angular distributions in neutron-induced reactions, Z = 1 to 22 and Z = 23 to 94, 17: 28240 (BNL-400(Vols.I and II))
GOLDFEDER, Anna, Radiosensitivity at the subcellular level, 17: 27135
GOLDMANN, Jack B., Bibliography on thermodynamic properties of Mo and Nb, 17: 27793 (NP-12938)
GOLDSTEIN, M. J., Deuterium isotope effect in intramolecular insertion, 17: 27411
GOLOVIN, B. M., Effects of high-energy protons on Si photoelements, 17: 27891 (JINR-P-1247)
GONZALEZ, F. Alvarez, Spectrochemical analysis of nuclear materials, 17: 27270
GOOD, R. J., Wetting of solids by liquid H, 17: 28083
GOOD, Robert A., Graft-host interactions across barriers in mice, 17: 27122
GOODING, T., Coaxial gun for plasma propulsion, 17: 28362 (NP-12935)
GOODMAN, Donald E., FLOCK—program to obtain fitted self-shielding coefficients, 17: 28440 (KAPL-M-RPC-8)
GORBUNKOV, V. M., Refractive index of liquid H, 17: 28035
GORDON, Charles L., Controlled atmosphere chamber, 17: 27514
GORDON, Louis, Precipitation with N-benzoylphenylhydroxylamine acetate, 17: 27299
GORSHKOV, V. G., Asymptotic relations for scattering, 17: 28218
GORYUNOV, A. A., Bibliography on Ru and Os, 17: 27400
GOSLEE, David E., Peformance of stainless steel–UO_2 cermet fuels, 17: 27863
GOTTLIEB, B., Termination of solar wind and solar magnetic field, 17: 28111
GOTTLIEB, Milton, Evaporation of Mo in Cs vapor, 17: 27967
GOTTLIEB, Milton, Thermal conductivity of Cs vapor, 17: 27957
GOULDING, Frederick S., Compensated-surface oxide-passivated Si junction radiation detectors, 17: 27695
GOULIANOS, Konstantin, Proof of existence of two neutrinos, 17: 28152 (NEVIS-113)
GOUPIL, Jean, Display device for cyclically checking a multiplicity of points, 17: 27679
GOUYON, Arthur Marcel, Stabilizing gain of photomultiplier tubes, 17: 27675
GOVORKOV, B. B., Photoproduction of π^0 mesons on protons, 17: 28204
GRAHAM, Leslie Wilfred, Treatment of C and graphite articles, 17: 27884
GRAMBERG, G., Developments in thermoelectricity, 17: 27998
GRANDE, Francisco, Absorption of radioactive albumin from lungs of normal dogs, 17: 27041
GRANDPIERRE, R., Gamma spectrometric explorations on patients taking cure at Luchon, 17: 27042
GRANTHAM, L. F., Electrical conductivities of molten Bi–BiI, solutions, 17: 27318 (NAA-SR-8086)
GRAVES, E. R., Howard Eberline neutron survey instrument PNC-1, 17: 27685 (LA-2860)
GRAVES, W. E., Buckling and void effects in D_2O moderated, organic, or H_2O cooled lattices, 17: 28483 (TID-18895)
GRAVES, W. E., Bucklings and void effects in heavy water lattices, 17: 28134
GRAY, D. A., Measuring apparatus used during design of Nimrod magnet, 17: 28349 (NIRL/R/4)
GRDENIC, D., Crystal structure of Ce(IV) acetylacetonate, 17: 27329
GREENBERG, E., Strontium-85 and Ca-47 uptake by bone metastases, 17: 27019
GREENBERG, O. W., Quantum field-theory model, 17: 28022
GREENWALD, Bertrand W., Irradiation of hydrocarbon oils, 17: 27647
GRIBOV, V. N., Strong interactions of elementary particles, 17: 28200
GRIEM, Melvin L., X-ray-induced dysplasia in mouse hair, 17: 27174
GRIFFEL, Maurice, Gas handling systems for radioactive gases, 17: 28517
GRIGOR'EVA, G. M., Effects of high-energy protons on Si photoelements, 17: 27891 (JINR-P-1247)
GRISARU, M. T., Scattering amplitudes in perturbation theory. I., 17: 28164
GRISARU, M. T., Scattering amplitudes in perturbation theory. II., 17: 28166
GRISMER, Jerome T., Absorption of radioactive albumin from lungs of normal dogs, 17: 27041
GRONA, L. Ya., Neutron scattering by Mg at 14 Mev, 17: 28276
GROND, J. Th. H., Medical care in disasters. II., 17: 27623
GRONINGER, R. D., Flow induced deflections of parallel flat plates, 17: 27552
GROPYANOV, V. M., Kinetics of dispersion of some refractory materials, 17: 27873
GROSHEV, L. V., Levels of Sn-150 excited in (n,γ) reaction, 17: 28305
GROSSMAN, L. N., Boride thermionic cathode materials, 17: 27966
GROSSMAN, L. N., Thermophysical properties of UC, 17: 27838
GROVE, D. J., Variation of neutral density with time in C-stellarator discharges, 17: 28348 (MATT-161)
GROZIER, J. D., Effects of Si, N, and O on corrosion zircaloy-2, 17: 27751 (WAPD-T-1567)
GROZIN, B. D., Possibility of strengthening steel in electron irradiation, 17: 27905
GRUBER, Liselotte, Induction of temporary epilation with soft and hard radiation, 17: 27105
GRYNBERG, M., Four-pion wave functions, 17: 28162
GUARE, C. J., Yttrium and rare earth vanadates, 17: 27217
GUCZI, L., Radiation effects on properties of Ni, 17: 27483
GUGGENHEIM, J., $PdTe_2$—superconductor with CdI_2 structure, 17: 27816 (UCRL-Trans-921)
GUIDERI, R., Intestinal absorption of Ca-45 in senile osteoporosis, 17: 27017
GUILLOT, P., Nondestructive analysis of fuel elements containing U-235, 17: 27229 (EUR-248.f)
GUILLOU, R. B., Fort McClellan radiological instruction area (ARMS-II), 17: 26945 (CEX-62.6.2)
GUMNICK, J. L., Migration of Cs on Re and W, 17: 27971
GUNN, Stuart R., Comparison standards for solution calorimetry, 17: 27323 (UCRL-7325-T)
GUNN, Stuart R., Heat formation of XeF_4, 17: 27321 (UCRL-7298-T)
GUNN, Stuart R., Heats of explosion of unstable gaseous hydrides, 17: 27322 (UCRL-7301-T)
GUNSON, W. E., MHD power conversion, 17: 28548
GUNTER, E. J., Prog. rpt. on gas-lubricated bearings, 12/62–2/63, 17: 27510 (TID-18924)
GURSKII, A. V., Experimental studies of cosmic radiation effects on higher plants, 17: 27201
GUTER, R. S., Analysis and processing of experimental results, 17: 27726
GUTHRIE, J. E., Radiostrontium, radiocesium and total β activities in Ottawa River water, 17: 27585 (AECL-1765)

GUZENKO, S. Ya., Asymptotic value of vertex function, 17: 28216
GVERDTSITELI, I. G., Equilibrium vapor pressure ratios of two isotopes, 17: 28270
GWIN, R., Scintillation process in CsI(Tl). I., 17: 27463
GWIN, R., Scintillation process in CsI(Tl). II., 17: 27464
GYURDZHIAN, A. A., Biological effects of cosmic radiation in satellite vehicle, 17: 27197

H

HAARHOFF, P. C., Approximation to density of vibrational energy levels, 17: 27367
HABERMANN, C. E., Welding Ta for high-temperature applications, 17: 27768
HADJIMICHAEL, E., Inelastic scattering of 166-Mev O-16 ions by Ta-181, 17: 28259 (UCRL-10825)
HADJIMICHAEL, E., Phase-shift analysis of heavy ion scattering, 17: 27949 (UCRL-10769)
HAFER, D. E., Superheat strain-cycle capsule, 17: 28430 (GEAP-3933)
HAGAN, Lucy Gay, Absolute intensity of C_2 swan bands, 17: 27324 (UCRL-10620)
HAGEBOE, E., Fission yields of Sb-127 and Sb-129, 17: 28278
HAGEN, Ulrich, Effective mechanism of serotonin as radiation protector, 17: 27154
HAGLUND, E. A., Superheat strain-cycle capsule, 17: 28430 (GEAP-3933)
HAGSTROM, Jack W. C., Acute radiation nephritis, 17: 27203
HAINSKI, Z., Determination of impurities in Al and SAP, 17: 27271
HAISSINSKY, M., Gamma radiolysis of $K_4Fe(CN)_6$ and $K_3Fe(CN)_6$, 17: 27441
HAISSINSKY, M., Radiolysis of noble metal compounds. II., 17: 27442
HALDEN, F., Recent activities in plasma technology, 17: 26960
HALDEN, F. A., Verneuil crystal growth in the arc-image furnace, 17: 27515
HALL, E. O., Radiation damaged and strain-aged mild steel, 17: 27909
HALL, K. L., Prog. rpt. on radiolysis of organic fluids. Annual, 10/61–9/62, 17: 27423 (TID-18195)
HALLDEN, Naomi A., Radium-226 in human diet, 17: 27051
HALPERIN, J., Capture/fission ratio of U-233 for epithermal neutrons, 17: 28309
HALTEMAN, E. K., Analysis of Pu and U compound mixtures, 17: 27256
HAMBERGER, S. M., Modulation of Balmer light from a h-f discharge, 17: 28026
HAMILTON, Gordon W., Hydromagnetic wave propagation near ion cyclotron resonance, 17: 28391
HAMM, K., Fast neutron capture in Th-232, 17: 28279
HAMME, John V., Phase relationships in U–C–O system, 17: 27802 (TID-18809)
HAMMER, D. C., Bremsstrahlung from electron-bombarded thin Au foils, 17: 28313
HAMMOND, J. P., Fabrication of U–Mo–UO_2 and U–Mo–UC fuels, 17: 28531 (ORNL-3437)
HANDA, Muneo, Fission products captured in graphite. VI., 17: 27999
HANDA, Muneo, Fission products captured in graphite. VII., 17: 28000
HANDEL, Neil E., Density measuring apparatus, 17: 27681
HANDLEY, Thomas H., Di-*n*-butyl phosphorothioic acid as extractant for metal ions, 17: 27408
HANDLEY, Thomas H., Dialkyl phosphorodithioic acids in liquid extraction systems, 17: 27407
HANSEN, William L., Compensated-surface oxide-passivated Si junction radiation detectors, 17: 27695
HANSON, W. C., Radioecological studies of northern Alaska, 17: 27053 (HW-SA-3050)
HARDY, Edward P., Jr., Prog. rpt. on fallout program, 3–5/63, 17: 27592 (HASL-138)
HARDY, Harriet L., Reaction to toxic Be compounds: terminology, 17: 27616
HARKNESS, A. L., Capture/fission ratio of U-233 for epithermal neutrons, 17: 28309
HARLEY, John H., Determination of Cs-137, 17: 27277
HARLEY, John H., Radiochemical determination of Sr-90, 17: 27276
HARLEY, John H., Radium-226 in human diet, 17: 27051
HARLOW, Francis H., Problem of vortex street development, 17: 27553
HARMUT, Magda, Evaluation of data in personnel exposed to radiation, 17: 27620
HARMUT, Magda, Whole-body counter, 17: 27691
HAROLD, M. R., Measuring apparatus used during design of Nimrod magnet, 17: 28349 (NIRL/R/4)
HARRIES, Wynford L., Equilibrium of current-carrying toroidal plasma, 17: 28392
HARRIES, Wynford L., Equilibrium of current-carrying toroidal plasma. II., 17: 28393
HARRIMAN, Louis A., Off-flavors in radiation sterilized beef, 17: 27648
HARRIS, Gale I., Properties of excited states of P-31. II., 17: 28321
HARRISON, S. E., Gamma-ray photoconductivity decay in organic dielectric materials, 17: 27895 (TID-18857)
HARTMAN, Jane, Food for survival is the dietitian's concern, 17: 27621
HARTNELL-BEAVIS, Michael Carl, Moderator core structures for nuclear reactors, 17: 28510
HARTUNIAN, R. A., Recombination rates in a shock tube, 17: 27373
HARVEY, E. B., Effects of x irradiation of ovarian ova, 17: 27119
HARVEY, Gladys A., Studies of ten solar active regions, 17: 28110
HASENCLEVER, B., Neutron flux and neutron dose, 17: 28492
HASKELL, G. P., Superconducting coil protection, 17: 27942 (NIRL/R/32)
HASTED, J. B., Charge transfer and ionization by positive ions, 17: 28054
HATADA, Motoyasi, Deuterium exchange of benzene with D_2O, 17: 27384
HATANO, Hiroyuki, Enzyme inactivation by γ radiation, 17: 27430
HATANO, Hiroyuki, Oxidative deamination of amino acids by irradiation, 17: 27431
HATANO, Hiroyuki, Radiation sensitivity of amino acids, 17: 27429
HATANO, Hiroyuki, Radiation effects on color of pearl, 17: 27901
HATSOPOULOS, G. N., Thermionic energy converter with liquid collector, 17: 27987
HAUSER, O., Irradiation of graphites, 17: 27917
HAUSER, R., Prog. rpt. on UO_2 extrusion, final, 3/63, 17: 27762 (EURAEC-368)
HAUSER, R., Uranium oxide sintering with view to increasing thermal conductivity, 17: 27814 (EURAEC-103)
HAWS, C. C., Sol gel process for preparation of thoria-base fuels, 17: 28469 (TID-7650(p.519-42))
HAYAKAWA, Jun-Ichiro, Radiosensitivity and thyroid function in mice, 17: 27173
HAYAKAWA, Shigeru, Radiation effects on electronic components, 17: 27919
HAYAKAWA, Sohachiro, Fluorescence of solution scintillators, 17: 27451
HAYASHI, Koichiro, Reaction between polymer radical and 1,1-diphenyl-2-picryl hydrazyl, 17: 27215
HAYASHI, Shigenori, Heat transfer in heterogeneous water reactor. I., 17: 28496
HAYASHI, Shigenori, Ion cyclotron resonance of plasma, 17: 28383
HAYES, Dallas T., Bethe-Goldstone equation for non-disappearing total impulse. II., 17: 28330
HAYES, W., Deformation of b.c.c. metals, 17: 27879
HAYWORTH, B., Coaxial gun for plasma propulsion, 17: 28362 (NP-12935)
HEALY, J. H., Prog. rpt. on refractory metal oxides, final, 6/61–6/63, 17: 27788 (LRR-41)
HEDDLE, D. W. O., Refractive indices of gases in vacuum ultraviolet. I., 17: 28028
HEDDLE, D. W. O., Refractive indices of gases in vacuum ultraviolet. II., 17: 28029
HEDGE, C. E., Strontium-87 as index of geologic processes, 17: 27582
HEIKEN, Aage, Chimerical structure of somatic Solanum mutant revealed by irradiation, 17: 27100
HEINRICH, H., Hollow control rods in three-group theory, 17: 28491
HELLIWELL, J. B., Magnetogasdynamic deflagration and detonation waves, 17: 28014
HELLWEGE, K.-H., Peroxide radicals in irradiated polypropylene, 17: 27450
HELM, Friedrich H., Numerical determination of flux perturbation by foils, 17: 28234
HEMMINGS, Robert Frederick, Improvements relating to electrical discharge apparatus, 17: 28403
HENDERSON, Cyril, Beta-decay branching ratio of the λ hyperon, 17: 28192

HENDERSON, R. W., Integral γ and neutron measurements on Kiwi-B-4A, 17: 28572 (LA-2885)
HENDRY, Barbara, Bibliography of publications of LASL research, 17: 26946 (LAMS-2895)
HENLE, Carye-Belle, Chronic internal irradiation in humans, 17: 27150
HENNICO, Alphonse, Longitudinal dispersion in packed extraction columns, 17: 27544 (UCRL-10696)
HENRY, A. F., Detailed time behavior of reactors, 17: 28485 (WAPD-T-1376)
HERENGUEL, J., FRITTOXAL technology, nuclear applications, 17: 27757 (EUR-273.f)
HERMAN, Jan A., Luminescence of irradiated rare gases, 17: 28011
HERNANDEZ, H. P., Superconducting critical currents in wire samples, 17: 28101
HERRINCK, P., Nuclear explosions applied to excavations and earthworks, 17: 27504 (EUR-7.f)
HERRINCK, P., Thermal applications of nuclear explosions, 17: 27505 (EUR-16.f)
HERSKOWITZ, Irwin H., Mutation frequency recovered from x-rayed sperm of Drosophila, 17: 27102
HEUSINGER, H., Exchange properties of ^{3}H-polyvinylacetate, 17: 27413
HEWITT, G. F., Film thickness and holdup measurements in vertical annular flow, 17: 27534 (AERE-M-1203)
HEWITT, G. F., Gaseous diffusion in porous media, 17: 27860
HICKEY, John L. S., Irradiated diets for rearing germfree guinea pigs, 17: 27004
HIESTER, N., Recent activities in plasma technology, 17: 26960
HIGASHI, I., Lattice constants of UC and UC_2, 17: 27815 (NP-tr-1027)
HIGASHIMURA, Takenobu, Radiothermoluminescence of polyethylene, 17: 27428
HIGASHIMURA, Takenobu, Thermoluminescence from γ irradiated amino acids, 17: 27427
HIGGINS, G. T., Pick-up of H in Magnox Zr-55, 17: 27846
HIGGINS, G. T., Secondary recrystallization in Magnox Al 80, 17: 27845
HILL, F. B., Axial mixing and mass transfer in fused salt–liquid metal extraction columns, 17: 27492 (BNL-791)
HILL, N. A., Hardness measurements on high-purity Be, 17: 27853
HILL, R. F., Emitter materials for noble gas plasma diode, 17: 27962
HILL, R. W., Suppressing photomultiplier noise, 17: 27657 (UCRL-6886 (Rev.1))
HINKLE, J. G., Prog. rpt. on gas-lubricated bearings, 12/62–2/63, 17: 27510 (TID-18924)
HINMAN, G. W., Accurate Doppler broadened absorption, 17: 28307
HIRATA, Masashi, Fetal disturbances due to radiation, 17: 27106
HIRONAKA, Yoshie, Isotopic exchange between propene and D_2O, 17: 27390
HIROTA, Kozo, Deuterium exchange of benzene with D_2O, 17: 27384
HIROTA, Kozo, Deuterium exchange reaction of p-xylene and anisole with D_2O, 17: 27387
HIROTA, Kozo, Electrolytic separation factor of H isotopes, 17: 27716
HIROTA, Kozo, Isotopic exchange between propene and D_2O, 17: 27390
HIRTZ, P., Uranium oxide sintering with view to increasing thermal conductivity, 17: 27814 (EURAEC-103)
HISANO, Takeo, Electrolytic separation factor of H isotopes, 17: 27716
HISKES, John R., Excitation and Lorentz ionization of 10-Mev hydrogen atoms, 17: 27950 (UCRL-10802)
HITCHCOCK, H. C., Superconducting critical currents in wire samples, 17: 28101
HJERTOQUIST, Sven-Olof, Effect of Sr intake on rats, 17: 27018
HOBBS, G. D., Impurity atoms in plasma possessing time varying electron temperature and density, 17: 28359 (CLM-R-3)
HODNETT, Ernest M., Tritium for determination of estrogen in tissues of broilers fed 3,4-dianisyl-2-*t*-3-hexene, 17: 27050
HOEKSTRA, E. K., Transfer function from reactor noise, 17: 28486
HOFFMAN, Charles C., Hazards rpt. on University of Cincinnati Nuclear Research Center, 17: 28566 (NP-12915)
HOFFMANN, V., Subacuteileus of the small intestine, 17: 27078
HOHMUTH, K., Decay of 27-hour Ho-166, 17: 28291
HOLAN, T., Influence of P-32 on tadpoles of *Rana temporaria*, 17: 27072
HOLCOMB, Rowland R., Decontamination of process water wastes. I., 17: 28582 (ORNL-3322)
HOLINKA, Miroslav, Compatibility of U–Ti system, 17: 27857
HOLLOWAY, L., Unitary symmetry model for photoproduction, 17: 28149 (LNF-63/21)
HOLMES, K. C., Attachment of complex uranyl fluoride to tobacco mosaic virus, 17: 27043
HOLZBERLEIN, Thomas M., Measuring lifetimes of excited atomic states and application to He, 17: 27943 (NP-12903)
HONDA, Yutaka, Activated sintering of UO_2. II., 17: 27766
HOOD, W. F., Harwell's reactors. II., 17: 28568
HOOPER, J. R., Prog. rpt. on heat rejection in nuclear space powerplants, 12/62–2/63, 17: 28574 (PWA-2197)
HOPE, R. S., Erosion-corrosion of Al alloys, 17: 27747 (HW-74359(Rev.))
HOPKINS, B. J., Work function in tubes with cathodes of U and Zr carbides, 17: 27975
HORAK, J. A., Radiation effects on Th and Th–U alloys, 17: 27887 (ANL-5674)
HORIKI, Oichiro, Radiation effects on electronic components, 17: 27919
HORIO, Masao, Effect of γ irradiation upon cellulose, 17: 27426
HORIO, Masao, Effect of γ irradiation upon wool fibers, 17: 27899
HORIO, Masao, Polymerization of styrene, methyl methacrylate, and acrylonitrile, 17: 27900
HORIUTI, Juro, Deuterium separation factor on Pt, 17: 27717
HORMANDER, Olof, How Sweden is developing its low-grade U_3O_8, 17: 27489
HORTON, K. E., Prog. rpt. on thermal-stress-fatigue of stainless steels, 1–3/63, 17: 27775 (ATL-A-135)
HORTON, Richard E., Irradiated diets for rearing germfree guinea pigs, 17: 27004
HOWARD, O. H., Continuous photometric fluorine analyzer, 17: 27251
HOWARD, Robert, Solar magnetic fields, 17: 28109
HOWARD, Robert A., Nuclear physics, 17: 28344
HOWARD, Roger, TE_{omn} modes of a quasi-co-axial resonant cavity, 17: 28373
HOYT, E. W., Boride thermionic cathode materials, 17: 27966
HU, C. T., Descriptors for two-phase automatic data retrieval system, 17: 27724 (TID-18886)
HUANG, Kun-Kuang, Experiment on $O^{18}(p,\gamma)F^{19}$ reaction, 17: 28290
HUBNER, R. S., ANNEX-1—program for shielding experiments, 17: 28223 (NAA-SR-Memo-8427)
HUD, Basilius, EGCR strain measurements and analyses, 17: 28482 (TID-18888)
HUDGENS, C. R., Phase equilibria for NaF–BeF_2–UF_4, 17: 27336
HUDSON, R. G., Thermionic cathode systems for fission-heat conversion, 17: 27960
HUETTIG, W., System U_3Si_2–UFe_2, 17: 27858
HUGHES, Garyth, Tubular carbon articles, 17: 27772
HUGHES, Vernon, Muonium: a new atom, 17: 28163
HUIZENGA, J. R., Cross sections for deuteron-induced fission, 17: 28314
HULLIGER, F., $PdTe_2$—superconductor with CdI_2 structure, 17: 27816 (UCRL-Trans-921)
HULM, J. K., Current-carrying capacity of superconducting solenoids, 17: 27944 (NP-12908)
HULM, J. K., High-field superconducting magnets, 17: 28074
HULUBEI, H., Contamination of vegetation by fission products, 17: 27604
HUMBACH, Walter, Fuel-rod structure for heterogeneous nuclear reactors, 17: 28520
HUMM, A. F., Jr., Reconditioning Brookhaven Graphite Reactor fuel-storage canal, 17: 28498
HUMPHREY, R. M., Radiation sensitization by 5-bromodeoxyuridine, 17: 27093
HUMPHREY, R. M., Survival of irradiated mammalian cells, 17: 27152
HUMPHREY, Ronald M., Ultraviolet sensitivity of hamster cells, 17: 27168
HUMPHRIES, D. G., Preparation of Te metal, 17: 27739
HUNDER, Gene G., Alterations of bactericidal property of rabbit serum, 17: 27125
HUNT, R. T., Internal insulation for liquid-H-fueled missiles, 17: 28089
HUNT, Vilma R., Analysis of teeth and bones for α-emitting elements, 17: 27172
HUNTER, G. J., Determination of radioruthenium, 17: 27224 (AERE-AM-68)
HURST, F. J., Thorium reserves in granitic rock, 17: 28450 (TID-7650 (p.29-56))
HUTCHINSON, D. L., Gamma-emitting radionuclides in newborns, infants and children, 17: 27013 (TID-18878)

HUWE, Darrell O., Properties of ω meson from $K^- + p \rightarrow \Lambda + \omega$, 17: 28159 (UCRL-10723)
HYATT, K., Biologic half life of Mg-28 in the dog, 17: 27022
HYMAN, J. T., Toroidal transformers and pre-amplifiers for monitors, 17: 27687 (NIRL/R/30)

I

IGO, George, Total reaction cross sections for heavy ions, 17: 28256 (UCRL-10766)
IHLE, H., Synergic solvent extraction system uranyl ion/tri-(n-octyl) phosphine oxide/di(2-ethylhexyl) phosphoric acid, 17: 27497
IIDA, Hiroyoshi, Radiation quantities and units, 17: 26956
IKADA, Yoshito, Effects of γ radiation on polymer in solution. IV., 17: 27902
IKADA, Yoshito, Effects of γ radiation on polymer in solution. V., 17: 27903
IKADA, Yoshito, Effects of γ radiation on polymer in solution. VI., 17: 27904
IKUSHIMA, Hiroshi, Radiation effects on electronic components, 17: 27919
ILES, R. S., Release of I-131 in Zenith containment, 17: 28418 (AEEW-R-172)
ILIESCU, C. C., Ideal polar surfaces, 17: 28350
IMAI, Yasuo, Radiation effect on the nucleic acid, 17: 27432
IMAMURA, Rikizo, Effect of γ irradiation upon cellulose, 17: 27426
IMGRAM, A. G., Tensile behavior of Mo–Ti, Cb–W–Mo–Zr, and Ta–W, 17: 27878
INCE, Arthur, Chemical polishing of Be, 17: 27745
INOENUE, E., Second order correction to average extrapolation length, 17: 28420 (CNAEM-8)
INOUE, T., X-ray-induced carcinoma simulating noma, 17: 27130
INOUE, Yasushi, Separation of Ir from irradiated Re, 17: 27459
IODICE, A. A., Glutamate isomerase reaction, 17: 26981
IONESCU, S., Methane radiolysis in an atomic reactor, 17: 27479
IORI, I., Measurement of the $Si^{28}(n,\alpha)Mg^{25}$ reaction, 17: 28295
IRANI, R. R., Determination of orthophosphate with cerous ion, 17: 27258
IRELAND, J. V., Charge transfer and ionization by positive ions, 17: 28054
IRISH, E. R., Prog. rpt. on fixation of radioactive residues, 1–3/63, 17: 28581 (HW-77299)
IRVINE, A. R., Kilorod facility, ORNL, 17: 28463 (TID-7650(p.351-83))
IRVINE, A. R., Thorium fuel cycle development facility conceptual design, 17: 28462 (TID-7650(p.333-50))
ISAACS, G. G., Thermionic generator with ion injection, 17: 27982
ISAACSON, J. H., Test for sex-linked lethals in irradiated mice, 17: 27098
ISAENKO, V. I., Directivity of the laser output, 17: 28063
ISAKOFF, L., Prog. rpt. on heavy water power reactors, 3–4/63, 17: 28526 (DP-845)
ISHIGURE, K., Radiation-induced copolymerizations of olefine monomers, 17: 27476
ISHIKAWA, Tadao, Production of high-purity artificial graphite, 17: 27742
ISHIKAWA, Tadao, Purification of raw coke for high-purity artificial graphite, 17: 27741
ISHIZUKA, Hiroshi, Interaction of plasma stream with dipole, 17: 28381
ISOYA, A., Inelastic scattering of 166-Mev O-16 ions by Ta-181, 17: 28259 (UCRL-10825)
ISOYA, A., Phase-shift analysis of heavy ion scattering, 17: 27949 (UCRL-10769)
IVANOV, V. A., Levels of Sm-150 excited in (n,γ) reaction, 17: 28305
IVANOVSKAYA, I. A., Production of strange particles by π^- mesons on Xe, 17: 28339
IWAZUMI, Tetsuo, Heat transfer in heterogeneous water reactor. I., 17: 28496
IZUMITANI, Tetsuro, Glass scintillator for γ-ray detection, 17: 27701

J

JABLONSKI, Francis E., Nuclear device for generating electric power, 17: 28560
JACKSON, C., Superconducting coil protection, 17: 27942 (NIRL/R/32)

JACKSON, Donald, Master and slave manipulating arrangements, 17: 27527
JACKSON, E. Atlee, Nonlinear coupled oscillators. II., 17: 28025
JACKSON, George Oliver, Nuclear reactors, 17: 28518
JACKSON, William G., Precipitation with N-benzoylphenylhydroxylamine acetate, 17: 27299
JACOBS, T. A., Recombination rates in a shock tube, 17: 27373
JACOX, Ralph F., Alterations of bactericidal property of rabbit serum, 17: 27125
JACQUES, Gabriel, Longitudinal dispersion in packed extraction columns, 17: 27544 (UCRL-10696)
JAEGER, P., Polymerization of methacrylamide and N-arylmethacrylamides, 17: 27448
JAMERSON, F. E., Nuclear generated plasmas in thermionic converters, 17: 27985
JAMES, Eleanor M., Magnetohydrodynamic boundary layer. II., 17: 27555
JAMES, J. N., Voyage of Mariner II, 17: 28577
JAMES, P. E., Silage density measured by γ attenuation, 17: 27645
JANAUER, G. E., Anion exchange of U and Th in ketone media, 17: 27503
JANAUER, G. E., Anion exchange of U, Th, Fe, and Al in acid–ether solutions, 17: 27296
JANISCH-RASKOVIC, W., Radiation therapy of genital carcinoma, 17: 27012
JANSSEN, Udo, Radiation hazard in treatment of skin diseases with Ra-224, 17: 27608
JAYARAMAN, A., Solid-solid transitions in Ti and Zr, 17: 27871
JAYE, S., Physics of the fueled, high-temperature GCR, 17: 28454 (TID-7650(p.128-47))
JEANMAIRE, Peter, Visualization of shock front in shock tube, 17: 28041
JECH, Cestmir, Detection of aerosols by recoil labeling with Rn decay products, 17: 27643
JEHENSON, P., FRITTOXAL technology, nuclear applications, 17: 27757 (EUR-273.f)
JEIJNSE, B., Some theoretical aspects of isotope studies, 17: 26955
JELINEK, J., Radiation effects on erythrocytes, 17: 27166
JELLINEK, S., Proliferation of elastic fibers after x irradiation, 17: 27133
JENKINS, G. M., Transient creep and recovery in graphite, 17: 27866
JENKS, G. H., In-pile radiation corrosion experiments with Zr, Ti, and steel alloys in UO_2SO_4, 17: 27750 (ORNL-3099)
JENNINGS, R. E., Refractive indices of gases in vacuum ultraviolet. I., 17: 28028
JEPHCOTT, D. F., Measurement of plasma density, 17: 28367
JIRKOVSKY, Rudolph, Rapid analysis of secondary β radiation, 17: 27283
JNANANANDA, Swami, Absorption of β radiation as function of atomic no., 17: 28184
JNANANANDA, Swami, End-point energy of β emitters, 17: 28183
JOHANNESEN, Rolf B., Controlled atmosphere chamber, 17: 27514
JOHNSON, A. A., Stage III recovery in neutron-irradiated Mo, 17: 27922
JOHNSON, Benjamin M., Solidification of radioactive waste, 17: 28585
JOHNSON, Irving, Uranium solubility in Ge, In, Tl, and Pb, 17: 27394
JOHNSON, J. W., Prog. rpt. on materials for high-temperature nuclear application, 1–4/63, 17: 27807 (TID-18891)
JOHNSON, Jesse C., Uranium and its potential market, 17: 26957
JOHNSON, Marjorie, Bibliography of publications of LASL research, 17: 26946 (LAMS-2895)
JOHNSON, W. E., Operational safety of nuclear installations, 17: 28487
JOHNSON, William, Carbon articles, 17: 27771
JOHNSON, William, Cementing process for carbon articles, 17: 27770
JOHNSON, William, Treatment of C and graphite articles, 17: 27884
JOHNSON, William, Tubular carbon articles, 17: 27772
JOHNSTON, F. J., Capture/fission ratio of U-233 for epithermal neutrons, 17: 28309
JOHNSTON, Joseph B., Jr., Bone marrow megakaryocytes of irradiated guinea pigs, 17: 27073
JOHNSTON, Thomas P., Formation of 1,5,7,11-tetrathiaspiro[5.5]-undecane, 17: 27412
JOHNSTON, W. H., Hydrazine formation in radiolysis of NH_3, 17: 27436
JOKELAINEN, Aili, Cs-137 and K in Finnish Lapps, 17: 27023
JONES, A. R., How far can we go with PWRs?, 17: 28542
JONES, C. H., A-c losses in hard superconductors, 17: 28099
JONES, L. V., Phase equilibria for $NaF–BeF_2–UF_4$, 17: 27336
JONES, L. V., Prog. rpt. on reactor fuels and materials, 1–3/63, 17: 27789 (MLM-1156)

JONES, P. F., Measuring apparatus used during design of Nimrod magnet, 17: 28349 (NIRL/R/4)
JONES, T. M., Thermal conductance of UO_2/SS interfaces, 17: 27546
JONES, Wm. Prichard, Interaction between solar wind and geomagnetic field, 17: 27574
JORGENSEN, Theodore, Jr., Electrons ejected from H and He gas by protons, 17: 28048
JUKES, J. D., Rayleigh-Taylor problem in magnetohydrodynamics, 17: 28012
JULIA, Roger, Sealing and centering device for rotary shaft, 17: 27523
JUNGCLAUSSEN, H., Decay of 27-hour Ho-166, 17: 28291
JUNGCLAUSSEN, H., Measurement of the decay scheme of I-131, 17: 28303
JUNGREIS, Ervin, Selective spot test for Eu, 17: 27300
JURCSIK (YURCHIK), Istvan, Determination of Th using arsenazo III, 17: 27246
JUST, Richard, Radiation dosimeter reader, 17: 27710

K

KABANOV, L. P., Design of nuclear power plant with separate superheated steam reactors, 17: 28549
KACHUR, E. V., Deformation texture of rolled Nb, 17: 27880
KACZMAREK, E., Distribution of mixture of particles, 17: 28161
KADANOFF, Leo P., Critical temperature of anisotropic superconductors, 17: 28044
KAERCHER, K. H., Treatment of late skin reactions to x rays, 17: 27104
KAESER, R. S., Helium-3 cryostat for oriented nuclei experiments, 17: 28092
KAGEYAMA, Kosuke, Photoneutron reaction of S-32, 17: 28286
KAHN, David S., Late effects of internal irradiation, 17: 27149
KAHN, J. S., Microhardness of single crystals of BeO, 17: 27343
KAKINUMA, T., Studies of ten solar active regions, 17: 28110
KALININA, I. D., Photometric determination of Be, 17: 27302
KALMUS, George E., Beta-decay branching ratio of the λ hyperon, 17: 28192
KALOS, M. H., Importance sampling in Monte Carlo shielding calculations. I., 17: 28411
KALTENBORN, N., Preparation of Cr-51 by Szilard-Chalmers reaction, 17: 27420 (KR-40)
KALYAZIN, E. P., Radiation induced reaction of heptane, nonane, or cumene with CO_2, 17: 27458
KAMEMOTO, Yuichiro, Determination of Hf in Zr, 17: 27289
KAMEMOTO, Yuichiro, Determination of Al by double activation analysis, 17: 27290
KAMIN, George J., Determination of O in V, Nb, and Ta, 17: 27257
KANAEV, N. A., Analytical reagents for Ce(IV), 17: 27304
KANE, J. J., Flow induced deflections of parallel flat plates, 17: 27552
KANE, R. P., Daily variation of cosmic meson intensity, 17: 28120
KANGAS, G. J., Pathfinder superheated steam heat transfer, 17: 28522 (ACNP-62030)
KANGRO, Walther, Production of heavy metals, U in particular, 17: 27490
KANTARDZHYAN, L. T., Photochemical behavior of uranin in liquid and solid solutions, 17: 27399
KAPLAN, C., Sources of positive ions for space charge neutralization, 17: 27984
KAPLAN, Selig N., Excitation and Lorentz ionization of 10-Mev hydrogen atoms, 17: 27950 (UCRL-10802)
KAR, K. R., Adsorption of P-32 by $SrSO_4$, 17: 27363
KARALOVA, Z. K., Determination of B in UF_4, 17: 27307
KARAPETYAN, V. E., Absorption and luminescence of divalent Sm, 17: 27372
KARAVAEV, G. F., Electron energy spectrum in Th_3P_4-type crystals, 17: 27391
KARNEY, D. H., Nucleolar responses to ionizing irradiation, 17: 27063 (TID-18846)
KARNIKOVA, Eva, Compatibility of U–Ti system, 17: 27857
KARPOV, V. L., Effect of γ irradiation on latexes, 17: 27934
KARPUSHKINA, E. I., Concentration of 'hot' component of plasma, 17: 28376
KARTTUNEN, J. O., Determination of Zr in U alloys, 17: 27255
KASH, S. W., Magnetic radiation shield minimal mass, 17: 28410
KASS, S., Effects of Si, N, and O on corrosion zircaloy-2, 17: 27751 (WAPD-T-1567)
KASSIMATIS, Constantin, Low reactivity measurement by sinusoidal source modulation, 17: 28489
KASTEN, Paul R., Review of Th reactor physics, 17: 28451 (TID-7650 (p.57-75))
KASTNER, Jacob, Radiation meter of extreme sensitivity, 17: 27706
KATAGIRI, Masataka, Uranyl tropolone-5-sulfonic acid chelate, 17: 27288
KATO, Takeshi, Study of stem leakage of ionization chamber, 17: 27699
KATO, Toyoaki, Solvent extraction of radio-Ru, 17: 27460
KATO, Toyoaki, Spectrophotometric determination of Ru, 17: 27287
KATSNEL'SON, B. A., Hygienic significance of natural radioactivity in mining, 17: 27603 (JPRS-19866)
KATSUURA, Kakuji, Effect of γ irradiation on red seaweeds, 17: 27132
KAUFMAN, Michele, Semiempirical electron affinities, 17: 27996
KAUFMANN, W., Theory of interaction between charged particles and totality of plasma electrons, 17: 28384
KAUN, K., Decay of 27-hour Ho-166, 17: 28291
KAUZLARICH, J. J., Compressible magnetogasdynamic boundary-layer flow, 17: 28010
KAWABATA, Akira, Irradiated triglycine sulfate dielectric behaviors, 17: 27916
KAWAMOTO, Takamichi (Takamiti), Glass scintillator for γ-ray detection, 17: 27701
KAWASAKI, Yoshihiro, Catalytic hydrogenation and D exchange reaction, 17: 27389
KAWASHIMA, Nobuki, Interaction of plasma stream with dipole, 17: 28381
KAZNOFF, A. I., Boride thermionic cathode materials, 17: 27966
KEATING, D. T., Interpretation of scattering from liquid-like binary, 17: 28137 (BNL-6364)
KEITH, J. R., Level structure of Sc-44, 17: 28249 (UCOL-P-518)
KELBER, Charles N., Code (1559/RE) to compute resonance integrals in mixtures, 17: 28219 (ANL-6709)
KELLER, D. L., Emitter materials for noble gas plasma diode, 17: 27962
KELLER, Joseph M., Resistivity of vacancy impurity pairs, 17: 27776 (BNL-6358)
KELLEY, K. K., Heat contents and entropies of Lu, Dy, and Ce, 17: 27314 (BM-RI-6248)
KELLY, Hugh P., Correlation effects in atoms, 17: 28049
KELLY, J. W., Texture of hot-pressed BeO, 17: 27850
KEMP, L. A. W., Construction of cavity ionization chamber, 17: 27163
KENDON, Martin Honess, Improvements in or relating to pumps, 17: 27524
KENNEDY, A. J., Cesium adsorption on refractory metals, 17: 27970
KENNEDY, G. C., Solid-solid transitions in Ti and Zr, 17: 27871
KENNER, B., Final rpt. on high-temperature materials, 1/3/62, 17: 27798 (RADC-TDR-62-307)
KENNY, P., Strontium-85 and Ca-47 uptake by bone metastases, 17: 27019
KENT, Ivor, Improvements in energy absorbing devices, 17: 28505
KENT, J. A., Modification of wood with polymers formed by radiation, 17: 27896 (TID-18907)
KENT, R. A. R., Cosmic neutron measurements, 17: 28118 (HW-SA-2870)
KENT, R. P., Creep of Mg–Zr alloy ZA, 17: 27849
KENT, Thomas H., Protective effect of β-mercaptoethylamine on intestine-irradiated rats, 17: 27112
KERMAGORET, Marcel, Stabilizing gain of photomultiplier tubes, 17: 27675
KERR, J. M., Fabrication of sol-gel thoria–urania, 17: 28473 (TID-7650 (p.606-13))
KESSLER, John O., Equilibrium of current-carrying toroidal plasma, 17: 28392
KESSLER, John O., Equilibrium of current-carrying toroidal plasma. II., 17: 28393
KESSLER, Wayne V., Determination of $CaCO_3$ moisture by radioisotope technique, 17: 27642
KHAMBATA, S. J., Presence of Th in the rock samples of Deccan traps, 17: 27571
KHASGIWALE, K. A., A-C polarography of U, 17: 27331
KHRAMCHENKOV, V. A., Polymerization of fluoro-olefines by radiation, 17: 27433
KIESSLING, R., Efficiency of liquid-liquid countercurrent extraction columns, 17: 27498
KILBY, G. E., Scattering of x rays by N_2, 17: 27953
KIMBER, A. R., Superconducting coil protection, 17: 27942 (NIRL/R/32)

KIMURA, Motoharu, Photoneutron reaction of S-32, 17: 28286
KIND, A., Shielding investigations at Ispra, 17: 28407 (EUR-142.d)
KING, C. D., Prog. rpt. on organic coolants, 1–3/63, 17: 28433 (IDO-11005)
KINUTANI, Kozuo, Fetal disturbances due to radiation, 17: 27106
KIRILLOVA, L. F., Elastic scattering of 8.35-Bev protons on protons, 17: 28207
KIRK, B. S., Thermodynamic properties of parahydrogen, 17: 28076
KISSENER, H. R., Isomerism of In-116, 17: 28310
KITRILAKIS, S., Heat conduction of Cs gas, 17: 27959
KITTEL, J. H., Radiation effects on Th and Th–U alloys, 17: 27887 (ANL-5674)
KLAMERUS, L. J., Stress detection by infrared inspection, 17: 27508 (SCTM-59-63(25))
KLEIMAN, Herbert, Nuclear moments of Hg-195, Hg-195m, and Hg-194, 17: 28284
KLEIN, Siegfried, Improvements in ion accelerators, 17: 28355
KLEINSTEUBER, A. T., Sol gel process for preparation of thoria-base fuels, 17: 28469 (TID-7650(p.519-42))
KLEMENT, W., Jr., Solid-solid transitions in Ti and Zr, 17: 27871
KLEPFER, H. H., Prog. rpt. on Zr alloy design, 7–9/62, 17: 27728 (GEAP-4076)
KLEPIKOV, N. P., Analysis of p-p interaction at 657 Mev. I., 17: 28147 (JINR-P-1266)
KLINGEN, Theodore James, Excitation functions of heavy ion nuclear reactions, 17: 28346
KLINGER, N., Reactions between refractory oxides and graphite, 17: 27344
KLIWER, J. K., Level structure of Sc-44, 17: 28249 (UCOL-P-518)
KLODT, Donald T., Prog. rpt. on Ti-modified $NbAl_3$, 3–5/63, 17: 27780 (DRI-2104)
KLYACHINA, K. N., Hygienic significance of natural radioactivity in mining, 17: 27603 (JPRS-19866)
KNECHTLI, R. C., Performance of auxiliary discharge thermionic energy converters, 17: 27983
KNIGHT, J. A., Radiation-induced cyanogenation of organic liquids, 17: 27437
KNIGHT, J. A., X irradiation of 2,2,4,6,6-pentamethylheptane, 17: 27465
KNYAZEVA, E. M., Photometric determination of Be, 17: 27302
KOBA, Z., Four-pion wave functions, 17: 28162
KOBAYASHI, R., Helium–N system, 0° to –140°C, 17: 28077
KOBAYASHI, Shigeo, Fluorescence of solution scintillators, 17: 27451
KOCH, L., Thermoemissive properties of UC, 17: 27978
KOCH, L. J., Future of fast breeders, 17: 28544
KOCHERZHINSKII, Yu. A., Study of Cr–Nb–Ti alloys, 17: 27826
KOCHESHKOV, K. A., Radiation synthesis of stannous dibromodibutyl, 17: 27481
KODA, Noriyuki, Study of stem leakage of ionization chamber, 17: 27699
KODA, Yoshio, Separation of pure Y-90 from Sr^{90}–Y^{90} mixture, 17: 27447
KOERNER, J., Transfer function synthesis as ratio of two complex polynomials, 17: 28490
KOESTER, D. W., Prog. rpt. on non-electrically conducting fine particulates, 3/61–9/62, 17: 27313 (ASD-TDR-62-843)
KOEVI, J., Radionecrosis of pituitary by action of Y-90, 17: 27191
KOIKE, A., Fate of Ehrlich cells injected into the portal system, 17: 26974
KOLDOBSKAYA, F. D., Ionizing radiation and metabolism, 17: 27192
KOLER, R. K., Casting of Al–Pu fuel elements, 17: 27758 (HW-69204)
KOLLMORGEN, G. Mark, Protective effect of β-mercaptoethylamine on intestine-irradiated rats, 17: 27112
KOLOUSEK, Jaroslav, Urinary excretion of P-32 in rats following irradiation, 17: 27037
KOMAREK, K. L., Reactions between refractory oxides and graphite, 17: 27344
KOMAROVSKII, A. N., Building constructions for accelerators, 17: 28353
KONDO, Masatsune, Versatile Co-60 irradiation facility, 17: 27513
KONDO, Michiyo, Reactions (α,p) on light and medium-weight nuclei, 17: 28288
KONDO, Takashi, Effect of γ irradiation upon wool fibers, 17: 27899
KONDO, Takashi, Polymerization of styrene, methyl methacrylate, and acrylonitrile, 17: 27900
KONDRAT'EVA, L. I., Spectrographic analysis of pure Bi, 17: 27309
KONIJN, J., Selective neutron detector in kev region, 17: 28237 (AE-102)
KONOVALOV, E. E., Spectrographic analysis of pure Bi, 17: 27309
KOPEC, M., Fibrinolytic activity in radiation in dogs, 17: 27212
KOPYLOVA, D. K., Inelastic π^--p interactions at 7 Bev, 17: 28205
KORKISCH, J., Anion exchange of U and Th in ketone media, 17: 27503
KORKISCH, J., Anion exchange of U, Th, Fe, and Al in acid–ether solutions, 17: 27296
KOSCHMANN, A. H., Descriptors for two-phase automatic data retrieval system, 17: 27724 (TID-18886)
KOSIEK, R., Photoprotons from N-15, 17: 28294
KOSKELIN, M., Gamma rays from $Al^{27}(p,\gamma)Si^{28}$ resonance, 17: 28328
KOSKI, W. S., Hydrazine formation in radiolysis of NH_3, 17: 27436
KOSTIAL, Krista, Effect of chelating agents on renal retention of U, 17: 27025
KOSTIAL, Krista, Toxicity of chelating agents for radiostrontium removal, 17: 27026
KOVYAZIN, N. V., Effects of cosmic flight factors in satellite vehicle "Vostok-2" on haploid and diploid yeast organisms, 17: 27199
KOWALEWSKY, Bruce, Uptake of radioactive material from reactor by mammals at NTS, 17: 27054 (TID-18864)
KRAKER, George P., Nuclear reactor and irradiating system, 17: 28571
KRAUS, Gerard, Reinforcement of rubber with irradiated carbon black, 17: 27649
KRAUSHAAR, J. J., Level structure of Sc-44, 17: 28249 (UCOL-P-518)
KRAWCZYNSKI, S., Mixer-settler for extraction experiments, 17: 27501
KREHBIEL, W. R., Nuclear reactor fuel quality, 17: 28432 (HW-SA-3045)
KREKELER, J. H., Removal of foreign organic materials from TBP–kerosene solvent, 17: 27405 (NLCO-882)
KRISE, George M., Low-dose radiation effects on litters of albino rat, 17: 27170
KRIVIT, William, New *in vivo* tracer method, 17: 26985
KRIVOV, M. A., Effects of γ radiation on GaAs properties, 17: 27908
KROH, J., Radiation produced peroxides of polymethylmethacrylate, 17: 27475
KRONAST, Benedikt, Pulsed source of fast neutrons, 17: 28329
KROPP, R. E., Computer program for analyzing pressure piping systems, 17: 27511 (WAPD-R(WB)-2)
KRUPNIKOVA-PERLINA, E. I., Deformation texture of rolled Nb, 17: 27880
KUBICA, Jozef, Changes in intestinal microflora in x-irradiated rats, 17: 27074
KUCHEROV, R. Ya., Equilibrium vapor pressure ratios of two isotopes, 17: 28270
KUCHITSU, Kozo, Significance of bond lengths determined by electron diffraction, 17: 27358
KUDRYAVTSEVA, N. V., Electron energy spectrum in Th_3P_4-type crystals, 17: 27391
KUEHN, W., Measurement of water content of sintering Fe, 17: 27282
KUEHNER, J. A., Spin-parity combinations for levels in Mg-24 and Si-28, 17: 28324
KUHLMAN, Carl W., Final rpt. on characterization of UO_2 powders, 17: 27811 (UNC-1004)
KUHLMANN-WILSDORF, D., Dislocation behavior of strained f.c.c. metals, 17: 27842
KUHNE, R. G., Superheat strain-cycle capsule, 17: 28430 (GEAP-3933)
KUILMAN, J., Thorotrast granuloma with recurrent nerve paralysis, 17: 26999
KUKACKA, L. E., Jr., Axial mixing and mass transfer in fused salt–liquid metal extraction columns, 17: 27492 (BNL-791)
KUKUSHKINA, V. A., Ionizing radiation and metabolism, 17: 27192
KULAKOV, V. M., Alpha decay of Am-241, 17: 28297
KULIKOVSKII, A. G., Magnetohydrodynamics, 17: 28070
KULSRUD, Russell M., Interchange instability in the stellarator, 17: 28389
KUMANIN, V. I., Refinement of Cr–Mo–V steel by Ce, 17: 27859
KUMAR, Shiv S., Structure of stars of very low mass, 17: 28108
KUMEKIN, Yu. P., Analysis of p-p interaction at 657 Mev. I., 17: 28147 (JINR-P-1266)
KUNCIR, G. F., Accurate Doppler broadened absorption, 17: 28307
KUNSTYR, I., Penetration of *Serratia marcescens* from intestine into the organism of irradiated dogs, 17: 27204
KUNZ, H. R., Prog. rpt. on heat rejection in nuclear space powerplants, 12/62–2/63, 17: 28574 (PWA-2197)
KUO, Mia-Kao, Radiation polymerization of acetylene hydrocarbons,

17: 27477
KUREPA, Milos, Physical parameters of a γ-absorption densitometer, 17: 27707
KURODA, Tsutomu, Oscillations in P.I.G. discharge, 17: 28382
KURTI, N., Temperatures below 1°K, 17: 28073
KURZWEG, Frank T., X-irradiation of lung and posterior mediastinum. IV., 17: 27127
KUSKEVICS, G., Optimization of Cs-surface ionizer materials, 17: 27989
KUWABARA, Sinzi, Similarity solutions for transient pinched plasma, 17: 28379
KUWATA, Keiji, Deuterium exchange of benzene with D_2O, 17: 27384
KUZIN, A. M., DNA in radiation damage of cell, 17: 27107
KUZIN, A. M., Metabolic processes in radiation damage of cell, 17: 27108
KUZMINSKII, A. S., Radiation vulcanizing of elastomers, 17: 27485
KUZNETSOV, E. V., Production of strange particles by π^- mesons on Xe, 17: 28339

L

LABATON, V. Y., Reaction of H with Zr–Ti alloy, 17: 27347
LABORIE, Paul, Spark chamber, 17: 27700
LABRIE, Roger J., Transference numbers in pure molten Na nitrate, 17: 27345
LAFFERTY, Walter J., Infrared spectrum of the $\nu_3 + \nu_4$ band of $C^{13}C^{12}H_4$, 17: 27362
LAFONTAINE, A., Irradiated foodstuffs and radiomimetic effects, 17: 27027
LAGERGREN, Curt, Effect of Sr intake on rats, 17: 27018
LAI, Tsai-teh, Cathodic action of metal complexes at dropping Hg electrode. VI., 17: 27340
LAKSHMINARAYANA, V., Z-dependence of pair cross section, 17: 28275
LAL, D., Cosmic-ray produced isotopes, 17: 28129
LAMB, Vernon A., Transference numbers in pure molten Na nitrate, 17: 27345
LAMERTON, L. F., Late effects of continuous irradiation, 17: 27147
LAMING, Linden Cyril, Improvements in reactor vessels, 17: 28514
LAMING, Linden Cyril, Improvements in steam generators, 17: 27558
LAMPE, F. W., Hydrazine formation in radiolysis of NH_3, 17: 27436
LAMPE, F. W., Scavenging of methyl-d, radicals by nitric oxide, 17: 27337
LANDAU, L. D., Lectures on nuclear theory, 17: 28415
LANDGREBE, Albert R., Radiostrontium removal from milk, 17: 27038
LANDON, Ernest Robert, Gas tight chambers for handling toxic substances, 17: 27526
LANDSMAN, A. P., Effects of high-energy protons on Si photoelements, 17: 27891 (JINR-P-1247)
LANE, J. A., Thorium utilization economics, 17: 28480 (TID-7650 (p.738-61))
LANE, W. B., Lanthanum-140 as radiotracer in chemical explosions, 17: 27640 (USNRDL-TR-638)
LANGBERG, Edwin, Prog. rpt. on fast wave plasma amplifier, 2/20/63, 17: 27650 (AD-297382)
LANGBERG, Edwin, Prog. rpt. on fast wave plasma amplifier, 11/20/62, 17: 28357 (AD-290086)
LANGROD, Kasimir, Method for producing high density UO_2, 17: 27773
LANTOS, C. P., Effect of storage on I-131 solutions, 17: 27247
LANZA, F., Power excursion reactor, 17: 28563 (EUR-271.i)
LARIONOVA, I. E., Spectrographic analysis of pure Bi, 17: 27309
LARKIN, A. I., Theory of superconducting Fermi fluid, 17: 28069
LAROIA, K. K., Silver La ferrite, 17: 27333
LARSON, Kermit H., Uptake of radioactive material from reactor by mammals at NTS, 17: 27054 (TID-13864)
LASHMET, P. K., Closed-cycle cascade He refrigerator, 17: 28079
LASSILA, Kenneth E., Inner bremsstrahlung transitions, 17: 28322
LATYSHEVA, V. I., Study of Cr–Nb–Ti alloys, 17: 27826
LAUBENSTEIN, R. A., Sources of positive ions for space charge neutralization, 17: 27984
LAUGHLIN, J. S., Strontium-85 and Ca-47 uptake by bone metastases, 17: 27019
LAVRUKHINA, A. K., Spallation of Fe nuclei by protons, 17: 28334
LAWRENCE, Arthur Charles, Improvements in steam generators, 17: 27558
LAWRENCE, Arthur Charles, Improvements in pressurized water reactors, 17: 28506
LAWRENCE, Arthur Charles, Pressure vessels for vapor generators, 17: 27528
LAYNER, D. I., Deformation texture of rolled Nb, 17: 27880
LAZARD, Bertrand, Methods for enriching ammonia in D, 17: 27718
LAZARUS, Allen K., Irradiation of hydrocarbon oils, 17: 27647
LAZOR, Michael Z., Early effects of radiation on renal function, 17: 27077
LAZZARA, R., Biologic half life of Mg-28 in the dog, 17: 27022
LEBEDEV, A. I., Photoproduction of π^0 mesons on protons, 17: 28204
LEBEDEV, V. I., Neutron-deuteron doublet scattering length, 17: 28210
LEBEDEVA, Z. V., Effect of pollen irradiated with x rays on self-fertilization of corn, 17: 27091
LEBERMAN, R., Attachment of complex uranyl fluoride to tobacco mosaic virus, 17: 27043
LEE, A. R., Charge transfer and ionization by positive ions, 17: 28054
LEE, P. K., Integral γ and neutron measurements on Kiwi-B-4A, 17: 28572 (LA-2885)
LE FEVRE, B. G., Average growth indices in U tubes containing texture gradients, 17: 27803 (TID-18815)
LEFFERT, C. B., Nuclear generated plasmas in thermionic converters, 17: 27985
LEFFERT, Charles B., Nuclear device for generating electric power, 17: 28560
LEHMAN, Richard Lawrence, Crystalline luminescence of cell-nuclear chemicals under radiation, 17: 27065 (UCRL-10724)
LEIMKUHLER, Ferdinand F., Trucking of radioactive materials, 17: 27599 (NYO-9773)
LEIST, N. R., Removal of foreign organic materials from TBP–kerosene solvent, 17: 27405 (NLCO-882)
LELAND, T. W., Helium–N system, 0° to –140°C, 17: 28077
LENCHEK, A. M., Geomagnetically trapped radiation, 17: 28131
LENGEMANN, F. W., Fluoridated water and skeletal uptake of Sr-85 and Ca-45 by young rats, 17: 27044
LENT, E. M., Light-collection efficiency of scintillation counters, 17: 27703
LEONARD, A., Energy dependent neutron transport theory. I., 17: 28229
LEONARD, R. L., Magnetohydrodynamics of partially ionized gases, 17: 27540 (NP-12767(p.65-7))
LEONTOVSKII, M. P., Interpretation of charge space, 17: 28174
LERAT, Jean-Marie, Methods for enriching ammonia in D, 17: 27718
LERFALD, G. M., Electron-density profiles in lower ionosphere, 17: 28018
LEROY, Rene, Pivot mountings for remote controls, 17: 27522
LESHER, S., Radiosensitivity of rapidly dividing cells, 17: 27138
LE STOURGEON, W. L., Characteristics of offspring from ten generations of x-irradiated male mice, 17: 27101
LEVINSTEIN, H. J., Dislocation behavior of strained f.c.c. metals, 17: 27842
LEVINTOV, I. I., Neutron spectrum and polarization in (d,n) reactions, 17: 28335
LEVINTOV, I. I., Polarization of recoil nuclei in stripping reactions, 17: 28336
LEVOY, Myron, Dual electric-nuclear engine, 17: 28575
LEVY, Ezra, Selective spot test for Eu, 17: 27300
LEVY, S., Prediction of critical heat flux in forced convection flow, 17: 27536 (GEAP-3961)
LEWIN, J. D., Superconducting coil protection, 17: 27942 (NIRL/R/32)
LEWINS, J., Two-group importance functions, 17: 28233
LEWIS, J. C., Radiation effects on photographic materials, 17: 27924
LEWIS, R. A., Identification of real and spurious scrams, 17: 28442 (NAA-SR-Memo-6688)
LEWIS, R. H., Thermal activation method for ρ_m measurements in enriched UO_2 lattices, 17: 28419 (BAW-1268)
LEY, S., Power excursion reactor, 17: 28563 (EUR-271.i)
LICHT, A. L., Quantum field-theory model, 17: 28022
LIDEN, K., Cs-137 and K in Finnish Lapps, 17: 27023
LIEB, Elliott, New method in theory of imperfect gases and liquids, 17: 28024
LIEBING, L., Plasma produced in a rail spark gap, 17: 28395
LIEBSCHUTZ, A. M., Shear loop for irradiation testing, 17: 28102
LIFFENGREN, D. J., Superheat strain-cycle capsule, 17: 28430 (GEAP-3933)
LIN, Chen-chong, Solution polymerization of vinyl acetate. V., 17: 27444
LIN, Teh-ping, Development of x-irradiated mouse oocytes, 17: 27117

LINCOLN, J. Virginia, Geomagnetic and solar data, 17: 28113
LINDER, Ernest G., Radioactive power supply system, 17: 28578
LINDLEY, John, Titanium evaporator for U and Pu liquors, 17: 27496
LINDQUIST, C. R., Liquid-H space tankage, 17: 28088
LINDQUIST, R., Effects of nuclear explosions on vlf propagation, 17: 26954
LINGENFELTER, R. E., Production of C-14 by cosmic-ray neutrons, 17: 28132
LISCIA, A., Extrusion fabrication of recycled thoria–urania, 17: 28471 (TID-7650(p.553-84))
LITHERLAND, A. E., Spin-parity combinations for levels in Mg-24 and Si-28, 17: 28324
LITTLE, C. G., Electron-density profiles in lower ionosphere, 17: 28018
LIVANOV, M. M., Problems of radiation effects on nervous system, 17: 27069 (JPRS-19284)
LIVANOV, M. N., Problems of radiation effects on the nervous system, 17: 27193
LOCKER, A., Mechanism of action of radioprotective agents, 17: 27189
LOGSDAIL, D. H., Dissolution rates of UO_2 sintered pellets in HNO_3 systems, 17: 27338
LOKEN, Merle K., Prevention of hepatic metastasis by $CrP^{32}O_4$, 17: 27126
LOMER, Jenifer N., Effect of electron irradiation on Cu, 17: 27921
LONG, G., Release of inert gases from UO_2, 17: 27886 (AERE-M-969)
LONG, R. A., Prog. rpt. on brazing refractory alloys, 2–4/63, 17: 27760 (NP-12901)
LOPACIUK, S., Fibrinolytic activity in radiation in dogs, 17: 27212
LORENZ, W., Influence of weak preirradiation on effects of strong dose of radiation, 17: 27137
LOSEV, V. V., Radiochemical studies of electrode processes on amalgams. II., 17: 27398
LOTHROP, Robert P., Compensated-surface oxide-passivated Si junction radiation detectors, 17: 27695
LOTTS, A. L., Fabrication of U–Mo–UO_2 and U–Mo–UC fuels, 17: 28531 (ORNL-3437)
LOTTS, A. L., Kilorod facility, ORNL, 17: 28463 (TID-7650(p.351-83))
LOTTS, A. L., Thorium fuel cycle development facility conceptual design, 17: 28462 (TID-7650(p.333-50))
LOVBERG, R. H., Coaxial gun for plasma propulsion, 17: 28362 (NP-12935)
LOVE, W. D., Biologic half life of Mg-28 in the dog, 17: 27022
LOVEGROVE, P. C., Film thickness and holdup measurements in vertical annular flow, 17: 27534 (AERE-M-1203)
LOWE, B. M., Deuterium oxide and its mixtures with H_2O, 17: 27379
LOWMAN, James T., New *in vivo* tracer method, 17: 26985
LOWREY, R. O., Internal insulation for liquid-H-fueled missiles, 17: 28089
LUBCHENKO, A. F., Theory of Mössbauer effect on impurity nuclei, 17: 28340
LUCKS, C. F., Specific heat and heat of fusion of K, 17: 27792 (NP-12933)
LUECK, Hans, Radiation effects on cellulose and plant structural substances, 17: 27088
LUHAN, John F., Hazards rpt. on University of Cincinnati Nuclear Research Center, 17: 28566 (NP-12915)
LUKIN, A. A., Effects of cosmic flight factors in satellite vehicle "Vostok-2" on haploid and diploid yeast organisms, 17: 27199
LUKIN, A. M., Photometric determination of Be, 17: 27302
LUKOVTSEV, P. D., Kinetics of electrochemical processes on oxidized electrodes. II., 17: 27397
LUK'YANOV, V. F., Photometric determination of Be, 17: 27302
LUNDBERG, R. E., Heat transfer in annular passages, 17: 27548
LUNDBERG, R. E., Heat transfer in annular passages, 17: 27549
LUNDGREN, T. S., Hamilton's variational principle for perfectly conducting plasma continuum, 17: 28388
LUNDIN, Charles E., Prog. rpt. on determination of Nb-rich region of ternary phase diagrams, 17: 27779 (DRI-2102)
LUTSENKO, V. N., Levels of Sn-150 excited in (n,γ) reaction, 17: 28305
LYNCH, C. T., Metal alkoxides as coatings for graphite, 17: 27727 (ASD-TDR-63-322)
LYNDS, C. R., Explosion in the center of the galaxy M82, 17: 28106
LYUBIMOV, G. A., Magnetohydrodynamics, 17: 28070
LYUBIMOV, V. B., Inelastic π^--p interactions at 7 Bev, 17: 28205
LYUBIMOV, V. N., Dipole structure and internal electric fields in $PbZrO_3$, 17: 27393
LYUL'KA, V. A., Isotropic relations for strange particle production, 17: 28172
LYUTYI, A. I., Excitation of atomic spectra in acetylene air flame, 17: 27371

M

MAASS, H., Action of x irradiation and cytostatic substances on tumor cells, 17: 27035
MABUCHI, H., Steam distillation of Po compound, 17: 27349
MABUCHI, H., Volatility of some Po compounds, 17: 27348
MABUCHI, Hisao, Isolation of carrier-free Te from Sb, 17: 27425
MACAGNO, E., Charged-particle observations in outer magnetosphere, 17: 28123
MAC DONALD, N. S., Gamma-emitting radionuclides in newborns, infants and children, 17: 27013 (TID-18878)
MACDOUGALL, J. D., PIXSE in thermal reactor calculations, 17: 28417 (AEEW-M-318)
MACKAY, K. J. H., Hardness measurements on high-purity Be, 17: 27853
MACKINTOSH, A. R., Model for electronic structure of metal W bronzes, 17: 27843
MAC NEIL, Robert L., Effect of partitions on dose rate in multistory windowless building, 17: 27601 (TO-B-63-6)
MADDOCKS, Kenneth, Organic liquid moderated and cooled reactors, 17: 28508
MAEHL, R., Kryptonates: Kr-85 becomes a universal tracer, 17: 27461
MAEHL, Richard H., Prog. rpt. on radiological mechanisms for geophysical research, annual, 1962, 17: 27564 (NYO-10219)
MAES, W., Radioelements in soil at Mol, 17: 27602 (EURAEC-416)
MAES, W., Treatment and storage of radioactive wastes, 17: 28579 (EURAEC-295)
MAFFEI, H. P., Neutron irradiation and cold work effects on Zy-2, 17: 27729 (HW-76636)
MAHANTY, J., Lattice perturbed by isotope defects, 17: 28007
MAHONY, John D., Half life of F-18, 17: 28250 (UCRL-10512)
MAIENSCHEIN, F. C., Depth-dose distribution produced in spherical water-filled phantom, 17: 27059 (ORNL-3457)
MAIENTHAL, E. June, Determination of Rh in Rh–U alloys, 17: 27259
MAIN, R. K., Inhibition of thymidine kinase–DNA polymerase activity in kidney by x radiation, 17: 27066 (USNRDL-TR-640)
MAJOR, K. G., Radiation effects on U thermal conductivity, 17: 27911
MAKAROV, A. V., Cascade apparatus to separate B isotopes, 17: 27715 (AEC-tr-5855)
MAKAROV, V. I., Radiation induced reaction of heptane, nonane, or cumene with CO_2, 17: 27458
MAKHANI, Joginder S., Late effects of internal irradiation, 17: 27149
MAKI, Arthur G., Absorption bands of CO_2, 17: 27361
MAKSAKOV, B. I., Absorption and luminescence of divalent Sm, 17: 27372
MALEEV, S. V., Scattering of slow neutrons by complex magnetic structures, 17: 28236
MALINOWSKI, Z., Radioactivity in foodstuffs, Poland, 1959–1961, 17: 27587 (CLOR-15)
MALISOV, E. V., Effects of γ radiation on GaAs properties, 17: 27908
MALJKOVIC, Teo, Toxicity of chelating agents for radiostrontium removal, 17: 27026
MALKINSON, Frederick D., X-ray-induced dysplasia in mouse hair, 17: 27174
MALKOV, Yu. S., Interaction between Ni_3Al and Ni_3Nb, 17: 27827
MALLARD, J. R., Clinical applications of γ camera, 17: 27002
MALLARD, J. R., Performance of γ camera for visualization of radioisotopes, 17: 27001
MALLICK, D. D., Discontinuity of velocity in parallel uniform magnetic field, 17: 28013
MALTSEV, V. M., Regularities in system of strange resonances, 17: 28148 (JINR-P-1287)
MALVICINI, A., Instrumentation for health physics' measurements, 17: 27682 (EUR-14.i)
MALVICINI, A., Measurements of ambient radioactivity—Ispra 1961, 17: 27591 (EUR-223.i)
MALYANOV, S. V., Effects of γ radiation on GaAs properties, 17: 27908
MALYSHEV, V. V., Spallation of Fe nuclei by protons, 17: 28334

MANGOLD, Helmut K., Analysis and purification of commercial radioiodinated triolein, 17: 26984
MANN, K. C., Decay of Ba-133, 17: 28267
MARAZAN, N., Effect of N on isotopic exchange between H and water vapor, 17: 27326
MARBURGER, I. L., Superheat strain-cycle capsule, 17: 28430 (GEAP-3933)
MARCAZZAN, M. G., Measurement of the $Si^{30}(n,\alpha)Mg^{27}$ reaction, 17: 28295
MARCINOWSKI, H.-J., Accidents in handling radioactive materials, 17: 27618
MARINKOVIC, S., Solid solution formation in $U_3O_8 \rightarrow UO_2$ transformation, 17: 27487
MARK, H., Use of He to provide near space environment, 17: 28075
MARKOWITZ, David, Critical temperature of anisotropic superconductors, 17: 28044
MARKOWITZ, Samuel S., Half life of F-18, 17: 28250 (UCRL-10512)
MARLOWE, O. J., Use of FORTRAN in large progams, 17: 27725 (WAPD-T-1591)
MAROV, G. I., Fission of U and Th by sub-barrier deuterons, 17: 28337
MARSDEN, Ernest, Alpha-particle activity from tobacco, 17: 27622
MARSLAND, D., Effects of D_2O on eggs of *Arbacia punctulata*, 17: 26975
MARTIN, Denis, Machine for removing fuel elements, 17: 27525
MARTIN, George, Vacuum properties of AgCl, 17: 28058
MARTIN, M. M., Fabrication of U–Mo–UO_2 and U–Mo–UC fuels, 17: 28531 (ORNL-3437)
MARTIN, P., Fast scaling circuit, 17: 27660
MARTIN, Troy C., Prog. rpt. on nuclear techniques in coal analysis, 5/62–1/63, 17: 27240 (TID-18883)
MARTINEZ, Carlos, Graft-host interactions across barriers in mice, 17: 27122
MARTINI, W. R., Flame-heated thermionic power sources, 17: 27963
MARTINI, W. R., Thermal conductivity of Cs vapor, 17: 27958
MARTINO, F., Crystal structure in the F-center spectrum of Cs halides, 17: 27377
MARTINOLI, Giuseppe, Radiation effects on root tips of *Avena sterilis*, 17: 27087
MARUYA, Kozuo, Activated sintering of UO_2. II., 17: 27766
MARYNOWSKI, C., Recent activities in plasma technology, 17: 26960
MASARIK, Vladimir, Compatibility of U–Ti system, 17: 27857
MASCHKE, A., Scavenging of methyl-d_3 radicals by nitric oxide, 17: 27337
MASEFIELD, J., Irradiator especially adapted for biological research, 17: 27116
MASON, E. A., Prog. rpt. on organic reactor coolants, 1–9/62, 17: 28441 (MITNE-29)
MASPES, P. E., Radioisotopic methods in diagnosis of intracranial tumors, 17: 26994
MASRI, E., Gamma radiolysis of $K_4Fe(CN)_6$ and $K_3Fe(CN)_6$, 17: 27441
MASSIMO, L., Dragon core, 17: 28459 (TID-7650(p.244-52))
MASSONET, L., Developments of the discharge chamber, 17: 27705
MASTROPAOLO, C., Gamma encephalography in diagnosis of cerebral lesions, 17: 26997
MASUDA, Akimasa, Partition coefficients and reciprocal ionic radii, 17: 27562 (INSJ-54)
MATHE, Georges, Secondary syndrome in allogenic marrow transplantation, 17: 26971
MATHIEU, Roger, Influence of nuclear factors on radiosensitivity, 17: 27141
MATHUR, Suresh C., Prog. rpt. on nuclear techniques in coal analysis, 5/62–1/63, 17: 27240 (TID-18883)
MATKOVIC, B., Crystal structure of Ce(IV) acetylacetonate, 17: 27329
MATOUSH, Leroy O., Nutrition of 96 naval recruits during a shelter habitability study, 17: 27612
MATSUI, Masakazu, Separation of Sc from Y, 17: 27369
MATSUURA, Kiyokata, Oscillations in P.I.G. discharge, 17: 28382
MATTHIAE, G., Absorption of π^- mesons in complex nuclei, 17: 28139 (ISS-63/28(p.1-11))
MATYUSHENKO, R. S., Density of high-melting powder compacts, 17: 27829
MAURANGES, P., Ionizing radiation for food preservation, 17: 27011
MAURI, R. E., Lubricants and thermal control materials under space conditions, 17: 27506 (NP-12906)
MAXIE, E. C., Recovery of γ-irradiated *Rhizopus stolonifer* sporangiospores, 17: 27118
MAY, Victoria M., Angular distributions in neutron-induced reactions, Z = 1 to 22 and Z = 23 to 94, 17: 28240 (BNL-400(Vols.I and II))
MAZDIYASNI, K. S., Metal alkoxides as coatings for graphite, 17: 27727 (ASD-TDR-63-322)
MAZE, R., High energy-photon-initiated E.A.S., 17: 28119 (PAN-382/VI)
MAZZA, F., Titanium nitrides as electrodes in Redox system, 17: 27346
MC ARDLE, A. Hope, Nucleoproteins in regenerating rat liver. II., 17: 26970
MC BRIDE, J. P., Reactor irradiation of thoria powders and pellets, 17: 28477 (TID-7650(p.675-95))
MC CALLUM, G. J., Spin of 3.70-Mev level in Al-25, 17: 28266
MC CARGO, M., Range of Xe-133 and Ar-41 ions in Al, 17: 28001
MC CLURE, G. W., Low-pressure glow discharge, 17: 27994
MC CONAHEY, Patricia J., Antibody formation by whole-body x radiation, 17: 27121
MC CONNON, D., Radioiodine sampling, 17: 27417 (HW-77126)
MC COURT, F. R., Kinetic theory of moderately dense gases, 17: 28039
MC CUEN, P. A., Heat transfer in annular passages, 17: 27548
MC CUEN, P. A., Heat transfer in annular passages, 17: 27549
MC CULLOCH, Donald George, Gas-sampling means for gas-cooled nuclear reactor, 17: 28507
MC CUTCHEON, Don M., Production confidence in NDT methods, 17: 27560 (WAPD-T-1530)
MC DERMOTT, M. N., Spin and nuclear moments of ground state of Cd-109, 17: 28312
MC DEVITT, Neil T., Infrared absorption spectra of rare earth oxides, 17: 27840
MC ELROY, M. B., Electron temperatures in ionosphere, 17: 28115
MC FEE, Arthur S., Prevention of hepatic metastasis by $CrP^{32}O_4$, 17: 27126
MC GAUGHEY, W. C., Ultrasonic investigation of stainless steel weld overlay, 17: 27761 (TID-18871)
MC GOWAN, Colin Ramsay, Testing for the presence of a component in liquors, 17: 27222
MC GREW, J. L., Liquid-H tank insulation, 17: 28086
MC INTOSH, J. E., Thermal conductance of UO_2/SS interfaces, 17: 27546
MC KAY, M. H., Intermediate-resonance formulas, 17: 28308
MC KISSON, R. L., Emitter corrosion in thermionic converters, 17: 27964
MC KISSON, R. L., Flame-heated thermionic power sources, 17: 27963
MC LAUGHLIN, William L., Evaluation of large radiation exposures, 17: 27594 (NBS-TN-161)
MC LENNAN, J. E., Radiation damaged and strain-aged mild steel, 17: 27909
MC MANIGAL, Paul G., Polarization and differential cross sections in p-p and p-nucleus scatterings, 17: 28157 (UCRL-10637)
MC MULLIN, P. G., High velocity drive for Mossbauer experiments, 17: 27665
MC NEILL, K. G., Yields and angular distributions of fast photoprotons, 17: 28265
MC NOWN, J. S., Tests on models of nuclear reactor elements. I., 17: 28445 (NP-12925)
MC TIGUE, Gerald E., Calculating U-235 outputs and charges, 17: 27713 (TID-8539)
MC VEY, William H., Calculating U-235 outputs and charges, 17: 27713 (TID-8539)
MEAGHER, T. F., Conversion of electromagnetic energy into shock pulses, 17: 27947 (TID-18816)
MEECHAN, C. J., Electron irradiation of ordered Cu_3Au, 17: 27892 (NAA-SR-Memo-504)
MEEKER, M., Heat conduction of Cs gas, 17: 27959
MEGY, Jean, Display device for cyclically checking a multiplicity of points, 17: 27679
MEHTA, Madan Lal, Energy levels of complex systems. IV., 17: 28282
MEHTA, Madan Lal, Energy levels of complex systems. V., 17: 28283
MEINKE, W. Wayne, Activation analysis and the research reactor, 17: 27241 (TID-18908)
MEISSNER, W., New effect at initiation of superconductivity, 17: 27951 (AEC-tr-5850)
MELDOLESI, G., Chemo-radiotherapy combinations, 17: 26990
MELE, A., Solid-state polymerization of phosphonitrilic chloride, 17: 27474
MELEHY, M. A., Einstein's diffusion-mobility relationship, 17: 28030

MELESHEVICH, A. P., Radiation effects on rubber–plastic systems, 17: 27931
MENEAR, J. R., Silage density measured by γ attenuation, 17: 27645
MENG, P. R., Inducer-impeller for liquid H, 17: 28093
MENIS, Oscar, Analysis of Pu and U compound mixtures, 17: 27256
MERCEA, V., Effect of N on isotopic exchange between H and water vapor, 17: 27326
MERCER, Walter A., Radioisotopic tracer techniques for detection and measurement of detergent residues, 17: 27637 (SAN-1020)
MERCER, Walter A., Radioisotopic tracer techniques for removal of pesticide residues from food, 17: 27638 (SAN-1021)
MERGELYAN, O. S., Vavilov–Cherenkov radiation in isotropic optically active medium, 17: 28186
MERINO, Ignacio, Endoscopy and endophotography with Debray-Segal rectoscope, 17: 27183
MERKEL, George, Reactions induced in Ni-58 with deuterons, 17: 28317
MERLINI, M., Fission products from fallout in lake biota, 17: 27588 (CNI-109)
MERLINI, Margaret, Radioactivation analysis in biology, 17: 26963 (EUR-128.i)
MERRIAM, M. F., Superconductivity in the In–Sn system, 17: 28047
MERRILL, H. K., Insulation techniques for liquid-H tanks, 17: 28087
MERSHAD, E. A., Determination of Pu by (ethylene dinitrilo)-tetraacetic acid titration, 17: 27250
MERY, Anne-Marie, Secondary syndrome in allogenic marrow transplantation, 17: 26971
MESCHERYAKOV, M. G., Analysis of p-p interaction at 657 Mev. I., 17: 28147 (JINR-P-1266)
MESSING, A. F., Phase diagram Ca–Zn, 17: 27800 (TID-17136)
MEYER, Lothar, Low-temperature camera for x-ray spectrography, 17: 27670
MEYER, R. A., Determination of C in Na, 17: 27317 (NAA-SR-7918)
MEYERAND, R. G., Jr., Collision probability of electrons with Cs atoms, 17: 27955
MICHAEL, H., Synergic solvent extraction system uranyl ion/tri-(n-octyl) phosphine oxide/di(2-ethylhexyl) phosphoric acid, 17: 27497
MIETTINEN, J. K., Cs-137 and K in Finnish Lapps, 17: 27023
MIGDAL, A. B., Theory of superconducting Fermi fluid, 17: 28069
MIHAJLOVIC, M., Effect of x radiation on soybeans, 17: 27071 (OTS-62-11755/2(p.99-100))
MIKHAILOV, I. N., Accuracy of u, v transformation method, 17: 28242 (JINR-P-1259)
MIKHAILOVSKII, A. B., Transverse oscillations of inhomogeneous plasma, 17: 28400
MIKHUL, E. K., Pole theory of Λ-hyperon production in π^--p interactions at high energies, 17: 28144 (JINR-P-1245)
MILAZZO, M., Measurement of the $Si^{28}(n,\alpha)Mg^{25}$ reaction, 17: 28295
MILLARD, Hugh T., Jr., Analysis of Po-210 and Pb-212 in minerals, 17: 27252
MILLER, A. E., Welding Ta for high-temperature applications, 17: 27768
MILLER, David J., Beta-decay branching ratio of the λ hyperon, 17: 28192
MILLER, J. T., Quality control instrumentation, 17: 27272
MILLER, Joshua, Graft-host interactions across barriers in mice, 17: 27122
MILLER, R. I., Prog. rpt. on hydrazine process, 2–4/63, 17: 27414 (ASD-TR-7-840A(IX))
MILLER, R. N., Foams and plastic films for insulation systems, 17: 28090
MILLER, R. S., Extrusion fabrication of recycled thoria–urania, 17: 28471 (TID-7650(p.553-84))
MILLER, Stanley L., Kinetic studies on hydrogenase, 17: 26983
MILLIKEN, M. Temple, Bibliography on transition metal refractory carbides, 17: 27809 (UCRL-7284)
MILSTED, J., Alpha decay of Cf-246, 17: 28318
MINARD, David, Nutrition of 96 naval recruits during a shelter habitability study, 17: 27612
MINARIK, E. V., Photoproduction of π^0 mesons on protons, 17: 28204
MINTS, R. S., Interaction between Ni_3Al and Ni_3Nb, 17: 27827
MIRETSKII, V. Yu., Radiation synthesis of stannous dibromodibutyl, 17: 27481
MIRONOVA, T. M., Ionizing radiation and metabolism, 17: 27192
MIROSHKINA, E. M., Titanium–Zr creep properties, 17: 27830
MISHINA, Masanori, Photoneutron reaction of S-32, 17: 28286
MISSMAN, R. A., Low-work-function collectors, 17: 27972
MISTRY, Nariman B., Interaction of high-energy neutrinos with matter, 17: 28151 (NEVIS-111)
MITCHELL, E. W. J., Electron spin resonance in irradiated diamond, 17: 27918
MITCHELL, O. M. Mrocek, Yields and angular distributions of fast photoprotons, 17: 28265
MITCHELL, R. I., Intestine during acute radiation syndrome, 17: 27205
MITRA, A. N., Three-particle unitarity in potential scattering, 17: 28188
MITROVIC, A., Effect of x radiation on soybeans, 17: 27071 (OTS-62-11755/2(p.99-100))
MITSUK, V. E., Zeeman effect in an alternating field, 17: 28034
MITTAL, M. L., Reaction between Th and Alkali molybdate, 17: 27457
MIYAHARA, Akira, Oscillations in P.I.G. discharge, 17: 28382
MIYAHARA, Koshiro, Exchange reaction between NH_3 and D, 17: 27386
MIYAMOTO, Toshiki, Criticality calculations of one-dimensional reactors, 17: 28495
MIYAUCHI, Terukatsu, Longitudinal dispersion in two-phase continuous-flow operations, 17: 27545
MIZUKAMI, Hideya, Effect of γ irradiation upon cellulose, 17: 27426
MLINKO, S., Gas analysis of tritium, 17: 27273
MOCOROA, A., Isomeric states of Y-90, 17: 28327
MOELLER, Goeran, Immunological enhancement of tumor homografts. III., 17: 26987
MOFFAT, A. J., Electron radiolysis of benzene–*m*-terphenyl and perdeuterobenzene–*m*-terphenyl mixtures, 17: 27418 (IDO-16876)
MOFFATT, W. C., Magnetohydrodynamics of partially ionized gases, 17: 27540 (NP-12767(p.65-7))
MOFFETT, R. J., Electron temperatures in ionosphere, 17: 28115
MOHAI, M., Determination of Th using arsenazo III, 17: 27246
MOHANTY, G. P., Prog. rpt. on refractory metal oxides, final, 6/61–6/63, 17: 27788 (LRR-41)
MOHILNER, Patricia R., Spot test for Be, 17: 27261
MOLER, R. B., L/K-capture ratio in Mn-54, Fe-55, Co-57, and Co-58 decays, 17: 28325
MOLONY, D. A., Final rpt. on high-temperature materials, 1/3/62, 17: 27798 (RADC-TDR-62-307)
MONASTERIO, G., Indicator methodology for diagnosis of tumors by means of radioisotopes, 17: 26992
MONKS, A. L., Cascade apparatus to separate B isotopes, 17: 27715 (AEC-tr-5855)
MONTA, Kazuo, Criticality calculations of one-dimensional reactors, 17: 28495
MONTAGNINI, B., Calculations of thermal utilization factor, 17: 28230
MONTGOMERY, P. O'B., Nucleolar responses to ionizing irradiation, 17: 27063 (TID-18846)
MOODIE, W. J., Prog. rpt. on organic coolants, 1–3/63, 17: 28433 (IDO-11005)
MOORE, Alan, Physical properties of Be–Fe alloys, 17: 27883
MOORE, Fletcher L., Novel radiotracer method for fluoride determination, 17: 27254
MOORE, G. E., Fate of Ehrlich cells injected into the portal system, 17: 26974
MOORE, W., Jr., Fetal metabolism of Cs-137 in rat, 17: 27036
MORENO, A. Moreno, Lead-212 in atmosphere of Mexico City, 17: 27628
MORGAN, R. H. C., Measuring apparatus used during design of Nimrod magnet, 17: 28349 (NIRL/R/4)
MORI, Akihiro, Ion cyclotron resonance of plasma, 17: 28383
MORI, Chizuo, Nondispersive x-ray spectrochemical analysis, 17: 27280
MORIKAWA, Kiyoshi, Catalytic hydrogenation and D exchange reaction, 17: 27389
MORIYAMA, Hideo, Interference of γ rays with action of X-agent on protein solution, 17: 27188
MORIYAMA, Hideo, Studies on X-agent. XVIII., 17: 27452
MORIYAMA, Hideo, Studies on X agent. XIII., 17: 27128
MORIYAMA, Hideo, Studies on X agent. XIV., 17: 27129
MORPURGO, Mario, Production of strong magnetic fields, 17: 28006
MORRIS, Peter R., Inversion of pole figures for materials having orthorhombic symmetry, 17: 27791 (NLCO-862(Rev.4))
MORRISON, Robert D., Tritium for determination of estrogen in tissues of broilers fed 3,4-dianisyl-2-*t*-3-hexene, 17: 27050
MORROW, Frederick, Physical properties of Be–Fe alloys, 17: 27883
MORSE, M. L., Galactose mutations of *E. coli* K-12, 17: 26980
MORSE, Peter H., X-ray-induced dysplasia in mouse hair, 17: 27174

MORSE, Theodore F., Dynamics of gases and plasmas, 17: 27539 (NP-12767(p.10-12))
MORUZI, M., Contamination of vegetation by fission products, 17: 27604
MOSIER, H. David, Measurement of early uptake of I-131 by thyroid, 17: 27048
MOSS, L. I., Experiments with Zr hydride critical assemblies, 17: 28481 (TID-18880)
MOSSER, Donn G., Analysis and purification of commercial radioiodinated triolein, 17: 26984
MOULE, G. L., Observation of the radiation from Jupiter, 17: 28114
MOUTSCHEN-DAHMEN, J., Irradiated foodstuffs and radiomimetic effects, 17: 27027
MOUTSCHEN-DAHMEN, M., Irradiated foodstuffs and radiomimetic effects, 17: 27027
MOYER, D. L., Gamma-emitting radionuclides in newborns, infants and children, 17: 27013 (TID-18878)
MRKOUS, Pavel, Influence of radiation on rubber, 17: 27915
MUELLER, C. B., Superconducting transition of Nb_3Sn-coated Nb wires, 17: 28098
MUELLER, G., Decay of 27-hour Ho-166, 17: 28291
MUELLER, J., $PdTe_2$—superconductor with CdI_2 structure, 17: 27816 (UCRL-Trans-921)
MUELLNER, St., Polymerization of ethylene by radiation, 17: 27478
MUENNICH, F., Lifetime of excited levels of Ca-42, 17: 28333
MULFORD, R. N. R., Decomposition pressure and melting point of UN, 17: 27356
MULLALY, R. F., Studies of ten solar active regions, 17: 28110
MULLINS, J. C., Thermodynamic properties of parahydrogen, 17: 28076
MUNOZ, E., Monocrystals of Tl-activated KI, 17: 28056
MUNSEE, J. H., Spatial resolution using liquid scintillators, 17: 27704
MURAMATSU, Susumu, Radiosensitivity and thyroid function in mice, 17: 27173
MURBACH, E. W., Refabrication of sintered UO_2–fissia pellets, 17: 27764
MURDOCH, A. M., Ultrasonic investigation of stainless steel weld overlay, 17: 27761 (TID-18871)
MURPHY, D. W., Insulation techniques for liquid-H tanks, 17: 28087
MURPHY, W. F., Radiation effects on Th and Th–U alloys, 17: 27887 (ANL-5674)
MURRAY, John L., Radiation-resistant mineral oils, 17: 27530
MURRAY, Joseph J., Jr., Properties of ω meson from $K^- + p \to \Lambda + \omega$, 17: 28159 (UCRL-10723)
MURRAY, R. B., Scintillation process in CsI(Tl). I., 17: 27463
MURRAY, R. B., Scintillation process in CsI(Tl). II., 17: 27464
MURRENHOFF, A., Synergic solvent extraction system uranyl ion/tri-(n-octyl) phosphine oxide/di(2-ethylhexyl) phosphoric acid, 17: 27497
MUTSURO, Naoshi, Photoneutron reaction of S-32, 17: 28286
MUYSKEN, M., State of development of water-cooled reactors, 17: 28536
MYASOEDOV, B. F., Separation and purification of Pa, 17: 27306
MYATT, J., Thermionic emission from ZrC, 17: 27977
MYERS, M. J., Clinical applications of γ camera, 17: 27002
MYERS, M. J., Performance of γ camera for visualization of radioisotopes, 17: 27001
MYERS, W. M., Accumulation of Sr-89 by plants, 17: 27055
MYLES, Kevin Michael, Thermodynamic properties of V–Fe alloy system, 17: 27774 (ANL-6657)

N

NACHOD, F. C., Impact of atomic energy on biology and medicine, 17: 27005
NADAREYSHVILI, K. Sh., Irritating effect of ionizing radiation, 17: 27070 (JPRS-19806)
NADOL'SKII, V. I., Technology of heavy concretes for protection against radioactivity effects, 17: 27930
NAGAO, Shigeo, Oscillations in P.I.G. discharge, 17: 28382
NAGARAJAN, G., Thermodynamic functions of TcF_6, 17: 27334
NAKAGAWA, Shigeru, Fetal disturbances due to radiation, 17: 27106
NAKAMURA, Minoru, Study of stem leakage of ionization chamber, 17: 27699
NAKAZATO, H., Fate of Ehrlich cells injected into the portal system, 17: 26974
NAPOLI, L. S., Wave propagation in tubular plasma, 17: 28390
NASHELSKII, A. Ya., Method of measuring microhardness, 17: 27874
NAUENBERG, Michael, Theory of final state interactions, 17: 28136 (BNL-6363)
NAUMANN, D., Adsorption investigations in nitrate fuses, 17: 27500
NAUMANN, D., Chlorination reprocessing of irradiated fuels. IV., 17: 27499
NAVERSTEN, Y., Cs-137 and K in Finnish Lapps, 17: 27023
NAYLOR, B. Maiken, Prog. rpt. on fast wave plasma amplifier, 11/20/62, 17: 28357 (AD-290086)
NAYLOR, Maiken, Prog. rpt. on fast wave plasma amplifier, 2/20/63, 17: 27650 (AD-29783)
NEDELJKOVIC, Ljubomir, Soil density determination, 17: 27301
NEDIALKOV, I. P., Algebraic equations for meson-nucleon scattering, 17: 28142 (JINR-E-1262)
NEDVEDYUK, K., Investigation of $C^{13}(t,\alpha)B^{11}$ reactions, 17: 28338
NELSON, Leslie C., Jr., Total U in flat fuel elements, 17: 27291
NELSON, Robert A., Final rpt. on characterization of UO_2 powders, 17: 27811 (UNC-1004)
NELSON, W. B., Prog. rpt. on Zr alloy design, 7–9/62, 17: 27728 (GEAP-4076)
NEMEROFF, Ken, Semiquantitative radioautography with tritiated compounds, 17: 27010
NEMILOV, Yu. A., Fission of U and Th by sub-barrier deuterons, 17: 28337
NEMODRUK, A. A., Determination of B in UF_4, 17: 27307
NESMEYANOV, An. N., Radioactive isotopes in nature, 17: 27584
NESTERKO, N. A., Excitation of atomic spectra in acetylene air flame, 17: 27371
NESTEROV, V. E., Earth's radiation belts at 180-250 km, 17: 28127
NETHERCOT, A. H., Jr., Switching speed of superconducting Sn, 17: 28045
NEUBERGER, J. W. K., Medical care in disasters. II., 17: 27623
NEUDOERFL, P., Peroxide radicals in irradiated polypropylene, 17: 27450
NEUKOMM, S., Radioprotective and radiosensitizing chemicals. IV., 17: 27182
NEUSEN, K. F., Pathfinder superheated steam heat transfer, 17: 28522 (ACNP-62030)
NEVITT, M. V., Ferromagnetism in V–Fe and Cr–Fe alloys, 17: 27801 (TID-17141)
NEWBOULD, P., Isotopically exchangeable Ca and absorption by plants, 17: 27046
NEWCOMB, Peter Cyrenius Adelbert, π^+-p scattering at 600 Mev, 17: 28156 (UCRL-10563)
NEWNHAM, R. E., Crystal structure of Y borates, 17: 27837
NEWTON, T. W., Kinetics of reaction between Pu(VI) and Fe(II), 17: 27316 (LADC-5517)
NGUYEN-VAN-HIEU, Quasioptical potential in model of quantum field theory, 17: 28146 (JINR-P-1253)
NICHOLS, B. D., Studies of Cs–CsF–Mo and Cs–CsF–W plasma diode emitters, 17: 27973
NICKS, R., Detection of penetration of fast neutrons in water, 17: 28221 (EUR-107.f)
NICKS, R., Gamma radiation curves for steel, Al, U, 17: 27889 (EUR-103.f)
NICKS, R., Shielding investigations at Ispra, 17: 28407 (EUR-142.d)
NICKS, R., Shielding of ORGEL critical experiment, 17: 28428 (EUR-149.f)
NIEDERMEYER, James F., Inversion of pole figures for materials having orthorhombic symmetry, 17: 27791 (NLCO-862(Rev.4))
NIENDORF, L. R., Liquid-H space tankage, 17: 28088
NIERENSKA, Emilia, Radiation protection in the world, with particular reference to Great Britain, 17: 27631
NIKITIN, V. I., High-temperature circuit for testing the stability and corrosion resistance of construction materials in liquid Na, 17: 27756
NIKITIN, Yu. P., π Meson production by μ mesons on nuclei, 17: 28341
NILSSON, N. Robert, Bibliography on plasma physics, 17: 28361 (NP-12921)
NISHIDA, Yoshihiko, Inelastic scattering of high-energy nucleons by nuclei, 17: 28300
NISHIDOI, Mutsumi, Adsorption of radioactive ions by calcined montmorillonite, 17: 27218
NISHIKAWA, Yasuharu, Separation of Sc from Y, 17: 27369
NIU, Keishiro, Pinch motion of cylindrical plasma, 17: 28378
NOGAMI, Yozo, Experiment on $O^{18}(p,\gamma)F^{19}$ reaction, 17: 28290

HORINDER, Olov, Two-group analysis of Xe stability in slab geometry, 17: 28416 (AE-108)
HORMAN, Amos, Radiation nucleation of bubbles in water, 17: 28032
HORMAN, G. E., Energy emitted in spectral lines by plasma, 17: 28385
HORWOOD, W. D., Early diagnosis and treatment of individuals who have excessive depositions of radioisotopes, 17: 27208
HOSOV, Yu. R., Neutron irradiation of Si p-n junctions, 17: 27929
HOTTINGHAM, W. B., Ionization of Cs at surfaces, 17: 27974
HOVICK, R., Spin and nuclear moments of ground state of Cd-109, 17: 28312
HOZAKI, Fumio, Catalytic hydrogenation and D exchange reaction, 17: 27389
HUCKOLLS, M. J., Lanthanum-140 as radiotracer in chemical explosions, 17: 27640 (USNRDL-TR-638)
HURUSHEV, S. B., Analysis of p-p interaction at 657 Mev. I., 17: 28147 (JINR-P-1266)
HYGAARD, Oddvar F., Conversion of thymidine to thymine nucleotides, 17: 26982
HYSTEN, K.-E., Gamma rays from $Al^{27}(p,\gamma)Si^{28}$ resonance, 17: 28328

O

OAKBERG, E. F., Genetic effects of radiation in mammals, 17: 27090
OBERLY, W. H., How far can we go with BWRs?, 17: 28543
OCHSENFELD, R., New effect at initiation of superconductivity, 17: 27951 (AEC-tr-5850)
OCHSENFELD, W., Mixer-settler for extraction experiments, 17: 27501
ODDIE, T. H., Thyroidal I-131 uptake rate in infants, 17: 27020
O'DELL, W. W., Tests on models of nuclear reactor elements. I., 17: 28445 (NP-12925)
ODINTSOV, A. I., Oscillator strength of resonance line of Ca, 17: 27370
OEHRL, Willi, Propagation of electromagnetic waves in plasma, 17: 28398
OEZEMRE, Ahmed Yueksel, Conversion factor of bare, critical multiplying media, 17: 28421 (CNAM-5)
OGAMI, Kozuo, Effect of γ irradiation upon wool fibers, 17: 27899
OGAMI, Kozuo, Polymerization of styrene, methyl methacrylate, and acrylonitrile, 17: 27900
OGDEN, H. R., Tensile behavior of Mo–Ti, Cb–W–Mo–Zr, and Ta–W, 17: 27878
OGIEVETSKII, V. I., Interacting fields of spin 1 and symmetry properties, 17: 28143 (JINR-P-1241)
OHARA, Akira, Radiation sensitivity of amino acids, 17: 27429
OHBA, Yujiro, Radiation from plasma sheath, 17: 28369
OHNO, Shinichi, Radiation effects on solid catalysts, 17: 27419 (JAERI-4024)
OHNUMA, Hojimo, Experiment on $O^{18}(p,\gamma)F^{19}$ reaction, 17: 28290
OHSHIKA, Masaki, Radioactive elements in sedimentary rocks, 17: 27579
OKA, Yoshinoge, Solvent extraction of radio-Ru, 17: 27460
OKA, Yoshinoge, Spectrophotometric determination of Ru, 17: 27287
OKA, Yoshinoge, Uranyl tropolone-5-sulfonic acid chelate, 17: 27288
OKAMURA, Seizo, Reaction between polymer radical and 1,1-diphenyl-2-picryl hydrazyl, 17: 27215
OKANO, Toshimasa, Effect of γ irradiation on red seaweeds, 17: 27132
OKONISHNIKOVA, I. E. (Ye.), Hygienic significance of natural radioactivity in mining, 17: 27603 (JPRS-19866)
OKOROKOV, V. V., Neutron spectrum and polarization in (d,n) reactions, 17: 28335
OKUBO, S., ϕ-Meson and unitary symmetry model, 17: 28154 (NYO-10264)
OLARIU, A., Effect of N on isotopic exchange between H and water vapor, 17: 27326
O'LAUGHLIN, Jerome W., Determination of O in V, Nb, and Ta, 17: 27257
OLIVER, J. H., Capture/fission ratio of U-233 for epithermal neutrons, 17: 28309
OLSEN, W. A., Level-gaging techniques for liquid H, 17: 28085
OL'SHANSKAYA, N. I., Radiation effects on insulating materials. V., 17: 27907
OLSON, W. M., Decomposition pressure and melting point of UN, 17: 27356
OMAN, R. A., Skimmer for high-intensity molecular beam, 17: 28042
ONAK, Thomas P., 1-Deuteriopentaborane rearrangement, 17: 27410
ONCESCU, M., Contamination of vegetation by fission products, 17: 27604
ONDOH, T., Cosmic noise absorption, auroral activity, and K-index at the auroral zone, 17: 28122
ONDOH, Tadanori, Ionospheric absorption of cosmic radio noise, 17: 28016
O'NEILL, G. F., Bucklings and void effects in heavy water lattices, 17: 28134
ORBISO, J. L., Vinyl acetate polymerization by γ radiation, 17: 27471
ORECHER, Severin, Gamma spectra of Cd-113, Ho-166, and Eu-154, 17: 28332
O'REILLY, B. D., Solution of transport equation in finite slab, 17: 28227 (WAPD-T-1392)
ORLOWSKI, S., Steam cycles for ORGEL power plant, 17: 28424 (EUR-83.f)
ORMEROD, M. G., Radiation protection by S in a model system, 17: 27438
ORNSTEIN, H. L., Prog. rpt. on heat rejection in nuclear space power-plants, 12/62–2/63, 17: 28574 (PWA-2197)
ORSENIGO, G., PCUT—program for recycle of power reactor fuel, 17: 28461 (TID-7650(p.285-332))
ORSZAGH, A., Radiation effects on polyamid films, 17: 27933
OSAKA, Yukio, Renormalization constant of electron gas, 17: 28377
OSAWA, Hisao, Determination of B in graphite, 17: 27286
OSBORNE, D. W., Viscosity of liquid He-3, 17: 28036
OSBORNE, James W., Protective effect of β-mercaptoethylamine on intestine-irradiated rats, 17: 27112
OSBORNE, M. F., Thorium fuel cycle irradiation program, 17: 28476 (TID-7650(p.643-74))
OSHIMA, K., Radiation-induced copolymerizations of olefine monomers, 17: 27476
OSIPENKO, B. P., Effects of high-energy protons on Si photoelements, 17: 27891 (JINR-P-1247)
OSIPOV, K. A., Titanium–Zr creep properties, 17: 27830
OSTER, Ludwig, Interaction of radiation and matter in plasma, 17: 28358 (ARL-63-62)
OSTERRIETH, Paul M., Induction by x rays of DNA distinction in *Escherichia freundii*. I., 17: 27113
OSTROVSKII, L. A., Magnetohydrodynamic waves, 17: 28401
OSWALD, Larry O., Beta-decay branching ratio of the Λ hyperon, 17: 28192
OVCHINNIKOVA, G. V., Determination of alkali metals, 17: 27243 (AEC-tr-5822)
OVCHINSKII, B. V., Analysis and processing of experimental results, 17: 27726
OZAKI, Atsumu, Catalytic hydrogenation and D exchange reaction, 17: 27389
OZAKI, Atumu, Deuterium isotope effect in ammonia synthesis, 17: 27385

P

PACE, Henry B., Low-dose radiation effects on litters of albino rat, 17: 27170
PADDEN, Thomas R., Changes associated with irradiation burnup of UO_2, 17: 27897 (WAPD-T-1501)
PADERNO, Yu. B., Silicides of Sc and Gd, 17: 27736
PAINE, S. H., Radiation effects on Th and Th–U alloys, 17: 27887 (ANL-5674)
PAIS, A., Many π-meson problem. II., 17: 28165
PALAIC, Dj., X-radiation and 5-hydroxytryptamine content of rats and mice, 17: 27110
PALAMARCHUK, A. S. (C.), Stimulation of root growth by radiation, 17: 27068 (CEA-tr-R-1678)
PALILLA, F. C., Field-induced luminescence of powdered phosphors, 17: 27342
PALSHIN, E. S., Separation and purification of Pa, 17: 27306
PAN, V. M., Phase diagrams for systems Cr–Nb and Cr–Nb–Ni, 17: 27825
PAN, V. M., Study of Cr–Nb–Ti alloys, 17: 27826
PANCHENKOV, G. M., Cascade apparatus to separate B isotopes, 17: 27715 (AEC-tr-5855)
PANDRES, Dove, Jr., Tensor virial theorems for variational wave functions, 17: 28050
PANDYA, S. P., Effective nuclear interactions, 17: 28302
PANFILOVA, E. P., Hygienic significance of natural radioactivity in mining, 17: 27603 (JPRS-19866)
PANKRATZ, L. B., Heat contents and entropies of Lu, Dy, and Ce, 17: 27314 (BM-RI-6248)
PANOSSIAN, Jacques, Sealing and centering device for rotary shaft, 17: 27523

PADLETTI, P., Radioisotopic methods in diagnosis of intracranial tumors, 17: 26994
PARFENOV, G. P., Effects of cosmic flight factors in satellite vehicle "Vostok-2" on haploid and diploid yeast organisms, 17: 27199
PARFENOV, G. P., Effects of cosmic flight factors on certain biological indices in insects, 17: 27200
PARK, David, Prog. rpt. on fast wave plasma amplifier, 2/20/63, 17: 27650 (AD-29782)
PARKER, W., Separation of I from Te, 17: 27495
PAROLI, G., Diagnosis of genital tumors with radioisotopes, 17: 26995
PARSONS, A. S. L., Refractive indices of gases in vacuum ultraviolet. I., 17: 28028
PARTHASARATHY, R., Electron-density profiles in lower ionosphere, 17: 28018
PARTINGTON, J. E., Measuring apparatus used during design of Nimrod magnet, 17: 28349 (NIRL/R/4)
PASARICA, Victoria, Inelastic π^--nucleon interactions, 17: 28171
PASCAL, Andre, Stabilizing gain of photomultiplier tubes, 17: 27675
PASK, Joseph A., Deformation and fracture of LiF, 17: 27839
PATEK, Paul R., Rat reticuloendothelial system and endocrine gland responses to foreign particles, 17: 26967
PATERA, I., Pole theory of Λ-hyperon production in π^--p interactions at high energies, 17: 28144 (JINR-P-1245)
PATERSON, Ian Laird McKenzie, Thermocouple arrangements for reactor fuel elements, 17: 28512
PATERSON, Philip Y., Effect of whole-body x irradiation on rats, 17: 27124
PATETTA-QUEIROLO, M. A., Biological effects of atomic radiations, 17: 27058 (NP-12897)
PATHAK, K. M., Hammer stars caused by Li-9—decay, 17: 28274
PATTERSON, D. A., Optical transmission of LiF, 17: 27354
PATTISON, W. L., Reactor irradiation of thoria powders and pellets, 17: 28477 (TID-7650(p.675-95))
PAULIKAS, George A., Excitation and Lorentz ionization of 10-Mev hydrogen atoms, 17: 27950 (UCRL-10802)
PAULY, Helmut, Synthesis of protein, RNA, DNA, and induced enzyme in *Bacterium cadaveris* after x irradiation, 17: 27109
PAVLOV, V. P., Spectral representations in perturbation theory, 17: 28209
PAVLOVSKII, F. A., Polarization of recoil nuclei in stripping reactions, 17: 28336
PAVONI, P., Pulmonary metastases from thyroid carcinoma, 17: 26998
PAVONI, P., Scintigraphy in study of metastases of thyroid adenocarcinoma, 17: 26996
PEARSON, J. A., Internal heat transfer in fuel elements, 17: 27551
PEARSON, R. L., Prog. rpt. on hydrazine process, 2–4/63, 17: 27414 (ASD-TR-7-840A(IX))
PECINA, R., Final rpt. on high-temperature materials, 1/3/62, 17: 27798 (RADC-TDR-62-307)
PEDERSEN, A., Effects of nuclear explosions on vlf propagation, 17: 26954
PEDRETTI, A., PCUT—program for recycle of power reactor fuel, 17: 28461 (TID-7650(p.285-332))
PEDRICK, Arthur Paul, Improvements in heat exchangers, 17: 27559
PEIZULAEV, Sh. I., Spectrographic analysis of pure Bi, 17: 27309
PEKAREK, V., Sorption on zirconyl phosphate, 17: 27351
PELEKHOV, V. I., Levels of Sm-150 excited in (n,γ) reaction, 17: 28305
PELLERIN, Achille, Machine for removing fuel elements, 17: 27525
PERELYGIN, V. P., Half life of spontaneously fissionable isomer, 17: 28241 (JINR-P-1258)
PEREY, F. G., FORTRAN program for calculating scattering of nucleons from nonlocal optical potential, 17: 28155 (ORNL-3429)
PEREY, F. G., Optical-model analysis of proton elastic scattering, 17: 28316
PERIKH, H., Effect of x ray on antigen metabolism in rabbit, 17: 27178
PERKINS, Frank C., Prog. rpt. on oxidation of beryllides, 6/12/63, 17: 27781 (DRI-2105)
PERKINS, M., Determination of radioruthenium, 17: 27224 (AERE-AM-68)
PERONA, J. J., Effects of fission product removal on costs of waste management. V., 17: 28583 (ORNL-3357)
PERRIN, P., Scattering of 14-Mev neutrons from C-12, 17: 28301
PETERS, B., Cosmic-ray produced isotopes, 17: 28129
PETERSEN, V. C., Prog. rpt. on refractory alloys, 4/15/61–11/15/62, 17: 27812 (WADD-TR-61-134(Pt.II))
PETERSON, Dorothy C., Ozone in radiation avoidance in the mouse, 17: 27175
PETROV, A. Z., Central-symmetric gravitational fields, 17: 28064
PETROVA, Jarmila, Restoration of irradiated cells, 17: 27095
PETRUKHIN, A. A., Angular distribution of cosmic muons, 17: 28133
PETRUKHIN, O. M., Extraction of Pu, 17: 27305
PETRUKHIN, V. G., Effects of cosmic flight in a satellite vehicle on cytological and histological changes in hematopoietic organs of mice, 17: 27198
PETRZHILKA, V., Peripheral pion-nucleon interactions, 17: 28208
PETZOLD, Wolfgang, Detection of Cu K–α radiation with proportional counters, 17: 27708
PEYRET, Roger, Shock conditions for magnetodynamic flow of fluids, 17: 28005
PEYSSOU, J., Uranium oxide sintering with view to increasing thermal conductivity, 17: 27814 (EURAEC-103)
PFAHLER, S. L., Phase I SNAP aerospace safety program, 17: 28573 (NAA-SR-8304)
PFEIFER, C. J., Data flow and storage allocation for PDQ-5 program on Philco-2000, 17: 28228 (WAPD-T-1589)
PFEIFFER, R. A., TRAM for Philco 2000, 17: 28222 (KAPL-M-RPC-1 (Rev.1))
PFISTER, Hans, Formation of electron-cavity pairs by x irradiation of barrier layers, 17: 27932
PHILLIPS, David M., X-ray-induced dysplasia in mouse hair, 17: 27174
PHILLIPS, G. C., First and second excited levels of Ne-19, 17: 28298
PICKLES, B. W., Pick-up of H in Magnox Zr-55, 17: 27846
PIDDINGTON, J. H., Auroral activity and trapped ions, 17: 28125
PIERCE, James C., Graft-host interactions across barriers in mice, 17: 27122
PIERPAOLI, V., Calculations of thermal utilization factor, 17: 28230
PIESCH, E., Dosimetry of fast neutrons, 17: 27692
PIGNOTTI, A., Inelastic processes in pion–pion scattering, 17: 28198
PIKAEV, A. K., EPR spectrum of a hydrated electron, 17: 27435
PILLON, J., Reactivity for different types of fuel cycles, 17: 28426 (EUR-129.f)
PILLON, J., Xenon effect on reactivity, 17: 28425 (EUR-102.f)
PIMENTEL, George C., Krypton fluoride: preparation, 17: 27743
PINCHUK, G. P., Spectrographic analysis of pure Bi, 17: 27309
PISARENKO, N. F., Earth's radiation belts at 180-250 km, 17: 28127
PISH, G., Phase equilibria for NaF–BeF_2–UF_4, 17: 27336
PITTMAN, Frank K., Objectives of U. S. Th fuel cycle programs, 17: 28448 (TID-7650(p.1-18))
PLEINEVAUX, C., Detection of penetration of fast neutrons in water, 17: 28221 (EUR-107.f)
PLEINEVAUX, C., DIFF—7090 FORTRAN program to determine neutron diffusion constants, 17: 28220 (EUR-106.f)
PLEINEVAUX, C., Shielding of ORGEL critical experiment, 17: 28428 (EUR-149.f)
PLESS, I. A., Precision-encoded memory (PEM), 17: 26949 (TID-18887)
PLUST, H. G., Developments in thermoelectricity, 17: 27998
PLYLER, Earle K., Absorption bands of CO_2, 17: 27361
PLYLER, Earle K., Infrared spectrum of the $\nu_4 + \nu_5$ band of $C^{12}C^{13}H_2$, 17: 27362
POCHIN, E. E., Diagnosis of thyroid tumors with aid of radioiodine, 17: 26993
PODGORETSKII, M. I., Inelastic π^--p interactions at 7 Bev, 17: 28205
POEVERLEIN, Hermann, Current density in plasma, 17: 28397
POLLARD, J. P., Intermediate-resonence formulas, 17: 28308
POLLOCK, Eugene N., Photometric determination of U by H_2O_2 method, 17: 27269
POLOWINSKI, S., Kinetics of graft copolymerization on preirradiated polymethyl methacrylate, 17: 27449
POLOWINSKI, S., Radiation produced peroxides of polymethylmethacrylate, 17: 27475
POLUBARINOV, I. V., Interacting fields of spin 1 and symmetry properties, 17: 28143 (JINR-P-1241)
POLYDOROVA, M., Automatic aerosol sampler, 17: 27580
POMRANING, G. C., Linear extrapolation distance, 17: 28235
POMRANING, G. C., Monoenergetic Boltzmann equation. I., 17: 28412
POMRANING, G. C., Monoenergetic Boltzmann equation. II., 17: 28413

POPOV, N. P., γ-Neutrino correlation in μ-meson capture, 17: 28215
POPOVIC, V., Correlation of radioactivity of specimens of air, 17: 27569
POPOVIC, V., Determination of apparent age of nuclear explosion, 17: 27570
POPOVIC, V., Methods for determination of atmospheric radioactivity, 17: 27568
PORETTI, G., Tritium content in organs after irradiation, 17: 27181
PORRITT, Roy, Opening irradiated silica ampoules, 17: 27213
PORTA, P., Solid-state polymerization of phosphonitrilic chloride, 17: 27474
PORTER, C. E., Statistical properties of spectra, 17: 27938 (BNL-6396)
POSER, H., Formation of Fe-59 from Co-59 by neutrons, 17: 28292
POSPISIL, J., Hematological changes in radiation sickness. IV., 17: 27202
POSPISIL, J., Penetration of *Serratia marcescens* from intestine into the organism of irradiated dogs, 17: 27204
POTTER, Richard L., Conversion of thymidine to thymine nucleotides, 17: 26982
POTTIER, Jacques, Improvements in ion accelerators, 17: 28355
POUYAUD, P., Grain boundaries in U–Mo alloys, 17: 27855
POWELL, E. R., TE_{omn} modes of a quasi-co-axial resonant cavity, 17: 28373
POWELL, Wilson M., Beta-decay branching ratio of the λ hyperon, 17: 28192
POZDEEV, V. V., Radiation synthesis of stannous dibromodibutyl, 17: 27481
POZZA, Franco, Increase in chemotherapeutic coefficient of mechlorethamine by action of Na DEDTC, 17: 27030
PRADDAUDE, Hernan C., Equation of motion for the density matrix, 17: 27991
PRASAD, Kedar N., Protective effect of β-mercaptoethylamine on intestine-irradiated rats, 17: 27112
PREECE, George Edward, Nuclear power plant, 17: 28559
PREOBRAZHENSKII, N. G., Applicability of the self-absorption method, 17: 27294
PREVOT, Francois, Ion injection device for plasma apparatus, 17: 28405
PRIBILLA, O., Strontium-90 content of human newborn, 17: 27033
PRICE, P. B., Ternary fission of heavy compound nuclei, 17: 28257 (UCRL-10772)
PRICE, P. B., Tracks of charged particles in high polymers, 17: 27925
PRICE, R. H., Diffusion coefficients for H in beta Zr, 17: 27844
PRICE, Robert B., Fission-fragment-induced stresses in ceramic materials, 17: 27888 (BMI-1635)
PRIDANTSEV, M. V., Effect of impurities and rare earth elements on properties of alloys, 17: 27881
PRIESTLEY, M. G., Magnetic breakdown in Mg, 17: 27870
PRIMAS, H., Analysis of high-resolution NMR spectra. I., 17: 28293
PROKESH, A., Production of strange particles by π^- mesons on Xe, 17: 28339
PROPST, R. C., Titration of Pu, 17: 27248
PRORIOL, Joseph, Calculation of Coulomb energy of He-3, 17: 28003
PROSDOCIMI, A., Activities of EURATOM dosimetry working group, 17: 27590 (EUR-88.f)
PROTTER, S. R., Reconditioning Brookhaven Graphite Reactor fuel-storage canal, 17: 28498
PROTTI, A. M., Steam sintering of UO_2 pellets, 17: 27740
PRPIC, Branko, Evaluation of data in personnel exposed to radiation, 17: 27620
PUIG, J. R., Radiation chemistry of ammonia: synthesis of hydrazine, 17: 27472
PYLE, I. C., Measuring apparatus used during design of Nimrod magnet, 17: 28349 (NIRL/R/4)
PYLE, Robert V., Diffusion from line source in magnetic field, 17: 28365 (UCRL-10801)
PYLE, Robert V., Excitation and Lorentz ionization of 10-Mev hydrogen atoms, 17: 27950 (UCRL-10802)

Q

QAIM, S. M., Method for radiochemical separation of Mo, 17: 27264
QUILLIGAN, J. J., Jr., Continuous Co-60 irradiation, 17: 27123

R

RABIN, S. A., Fabrication of U–Mo–UO_2 and U–Mo–UC fuels, 17: 28531 (ORNL-3437)
RABIN, S. A., Thorium fuel cycle irradiation program, 17: 28476 (TID-7650(p.643-74))
RABINOWITZ, G., Splitting as function of energy, photoneutron production and variance calculation in MONSTER, 17: 28246 (NDA-Memo-2123-1)
RABOLD, H., Water-chemistry problems in water-cooled reactors, 17: 28538
RADEKA, R., Determination of apparent age of nuclear explosion, 17: 27570
RADFORD, Edward P., Jr., Analysis of teeth and bones for α-emitting elements, 17: 27172
RAFIQ, Mohammed, Determination of small amounts of Zr. I., 17: 27298
RAIEVSKI, V., ECO—critical experiment for study of ORGEL lattice, 17: 28427 (EUR-130.f)
RAILEY, R. M., Lanthanum-140 as radiotracer in chemical explosions, 17: 27640 (USNRDL-TR-638)
RAINEY, R. H., Aqueous processing of Th fuels, 17: 28464 (TID-7650 (p.384-435))
RAJEWSKI, Boris, Time and intensity factors, 17: 27144
RAJEWSKY, B., Alpha-emitting nuclides in the human body, 17: 27285
RAKOVIC, M., Determining Au in biological material, 17: 27267
RAKOVSKII, V. S., Density of high-melting powder compacts, 17: 27829
RAMAKRISHNA RAJU, M., Absorption of β radiation as function of atomic no., 17: 28184
RAMAKRISHNA RAJU, M., End-point energy of β emitters, 17: 28183
RAMANIAH, M. V., Relative yields of Pd-111 and Pd-111m in the decay of Rh-111, 17: 28280
RAMA RAO, J., Z-dependence of pair cross section, 17: 28275
RAMASWAMY, M. K., Gamma rays following decay of Ti-45, 17: 28269
RAMDOHR, H. F., Activation analysis for Cu ore sorting, 17: 27281
RAMSEY, William J., Structures of Ba_3Pb_5, BaPb, and $BaPb_3$, 17: 27808 (UCRL-7030)
RANDIC, M., X-radiation and 5-hydroxytryptamine content of rats and mice, 17: 27110
RANKEN, W. A., Studies of Cs–CsF–Mo and Cs–CsF–W plasma diode emitters, 17: 27973
RAPIER, A. C., Thermal conductance of UO_2/SS interfaces, 17: 27546
RAPPAPORT, Paul, Radioactive batteries, 17: 27531
RASMUSSEN, John E., Psychologic discomforts in protective shelter tests, 17: 27611
RASMUSSON, D. C., Accumulation of Sr-89 by plants, 17: 27055
RASO, Dominic J., Scattering of γ rays in laminar media, 17: 28196
RASSOUL, A., Preparation of Cr-51 by Szilard-Chalmers reaction, 17: 27420 (KR-40)
RAUH, E. G., Thermodynamic study of Th–O system, 17: 27799 (TID-17092)
RAVERA, O., Fission products from fallout in lake biota, 17: 27588 (CNI-109)
RAVID, Efraim, Shock wave profiles in microwave Fabry-Perot interferometer, 17: 27662
RAVINDRAN, N., Relative yields of Pd-111 and Pd-111m in the decay of Rh-111, 17: 28280
RAY, Asit Kumar, Gravimetric determination of Th, 17: 27263
RAZ, Baruch, Electric resistance of sintered UO_2, 17: 27854
REAGAN, Daryl D., Heating mechanism for plasma, 17: 28364 (UCRL-7294)
REAMES, Donald V., Emission of charged particles in heavy ion interactions, 17: 28252 (UCRL-10693)
REDMAN, M. J., Crystal structure of Y borates, 17: 27837
REEVES, Andrew L., Humoral transport of Be, 17: 27045
REICHEL, R., Measuring of compounds labeled with C-14, 17: 27453
REID, George W., Prog. rpt. on sequestration of metal ions in brine using radioisotopes. Final, 1962, 17: 27320 (ORO-602)
REID, John H., Prediction of solar activity, 17: 28124
REINES, F., Spatial resolution using liquid scintillators, 17: 27704
REINHARTZ, K., Exchange properties of ^{3}H-polyvinylacetate, 17: 27413
REITER, R. A., Neutron absorption rates in lumped poisons, 17: 28244 (KAPL-M-SW-2)
REMBERGER, V. G., Ionizing radiation and metabolism, 17: 27192
RENAUD, Michel, Transfer of radiation into x fluorescence, 17: 28004
RENGAN, K., Relative yields of Pd-111 and Pd-111m in the decay of Rh-111, 17: 28280
RENNIE, C. A., Dragon Project, 17: 28534
RENO, T. J., Jr., SWAK—thermal cross section program, 17: 28243 (KAPL-

M-RPC-6)
REVILLE, P., Sarcoma of liver and hepatic thorotrastosis, 17: 27081
REVINA, L. D., Spallation of Fe nuclei by protons, 17: 28334
REX, Roy, Radioisotope techniques for atmospheric density measurements, 17: 27656 (NYO-9854)
REYNOLDS, Donald C., Energy storage device, 17: 28104
REYNOLDS, M. B., Fission gas pressure in operating fuel elements, 17: 27651 (GEAP-4135)
REYNOLDS, R. C., Nucleolar responses to ionizing irradiation, 17: 27063 (TID-18846)
REYNOLDS, S. A., Determination of Th in granite, 17: 27295
REYNOLDS, W. C., Heat transfer in annular passages, 17: 27548
REYNOLDS, W. C., Heat transfer in annular passages, 17: 27549
REYNOLDS, W. C., Turbulent heat transfer in a circular tube, 17: 27547
REYNOLDS, W. N., Microstructural changes in neutron-irradiated graphite, 17: 27910
RHINEHAMMER, T. B., Phase equilibria for $NaF–BeF_2–UF_4$, 17: 27336
RICCHENA, R., Power excursion reactor, 17: 28563 (EUR-271.i)
RICHARDS, E. W. T., Emission spectrum of Pa, 17: 28062
RICHARDS, R. E., Nuclear resonance spectra of electrolyte solutions, 17: 27365
RICHARDSON, L. S., Evaporation of Mo in Cs vapor, 17: 27967
RICHMAN, Isaac, Covalency effects in spectra of Pr^{3+} and Nd^{3+} in LaCl, and $LaBr_3$, 17: 27311 (AROD-2099.12)
RICHMAN, Isaac, Lattice vibration spectra of $LaCl_3$ and $LaBr_3$, 17: 27312 (AROD-2099.13)
RICHTER, Harold G., Prog. rpt. on double decomposition radio release analysis for Ca and phosphate ions. Final, 1962, 17: 27233 (ORO-588)
RICKARD, W. H., Radioecological studies of northern Alaska, 17: 27053 (HW-SA-3050)
RIEBOLD, W., Power excursion reactor, 17: 28563 (EUR-271.i)
RIEDEL, Guenter, Radioactively labeled aerosols, 17: 27644
RIEDLER, W., Effects of nuclear explosions on vlf propagation, 17: 26954
RIEMERSMA, H., High-field superconducting magnets, 17: 28074
RIGLER, Leo G., Roentgen diagnosis of upper G-I tract, 17: 26986
RINALDINI, C., Power excursion reactor, 17: 28563 (EUR-271.i)
RINKEVICS, M., Field-induced luminescence of powdered phosphors, 17: 27342
RISTINEN, R. A., Level structure of Sc-44, 17: 28249 (UCOL-P-518)
RIVAT, Michel, Tanks or enclosures for nuclear reactors, 17: 28569
RIVERA, Joseph, Prog. rpt. on fallout program, 3–5/63, 17: 27592 (HASL-138)
RIZAEV, Kh., Inelastic π^--p interactions at 7 Bev, 17: 28205
ROACH, F. E., Stable 6300 Å auroral arcs, 17: 28052
ROACH, J. R., Stable 6300 Å auroral arcs, 17: 28052
ROBERTS, D. M., Thermal activation method for ρ_{th} measurements in enriched UO_2 lattices, 17: 28419 (BAW-1268)
ROBERTS, F. P., Cesium-dipicrylamine solvent extraction studies, 17: 28580 (HW-76222)
ROBERTS, J. T., Effects of fission product removal on costs of waste management. V., 17: 28583 (ORNL-3357)
ROBINSON, L. B., Properties of a Cs plasma, 17: 27956
ROBINSON, W. H., Dislocation behavior of strained f.c.c. metals, 17: 27842
ROBKIN, M. A., Prog. rpt. on Pu recycle for water moderated reactors, 1–3/63, 17: 28431 (GEAP-4216)
ROBSON, Arthur Gray, Fuel elements for reactors, 17: 28511
RODRIGUEZ-GALINDO, M., Incorporation of S-35 in uterine secretions, 17: 27034
RODWELL, William, Joints between tubes of dissimilar materials, 17: 27529
ROESINGER, S., Polymerization of ethylene by radiation, 17: 27478
ROGERS, D. R., Determination of Pu by (ethylene dinitrilo)-tetraacetic acid titration, 17: 27250
ROGERS, E. J., Integrator for small pulsed and direct currents, 17: 27664
ROGERS, I. W., Characteristics of neon–alcohol spark chamber, 17: 27697
ROGERS, Jack C., Ignition of materials by large yield nuclear weapons, 17: 27945 (NP-12936)
ROGERS, Jim N., SHAPE—FORTRAN language computer program, 17: 27509 (TID-18844)
ROHRLICH, F., Principle of equivalence, 17: 27990
ROINE, P., Cs-137 and K in Finnish Lapps, 17: 27023
ROKUSHIKA, Souji, Enzyme inactivation by γ radiation, 17: 27430
ROKUSHIKA, Souji, Oxidative deamination of amino acids by irradiation, 17: 27431
ROLLEFSON, A. A., First and second excited levels of Ne-19, 17: 28298
ROLLINS, R. W., Hysteresis in hard superconductors, 17: 27993
ROMANI, R. J., Recovery of γ-irradiated *Rhizopus stolonifer* sporangiospores, 17: 27118
ROMANOV, A. M., Passage of charged particles through matter, 17: 28071
ROME, J., Studies of ten solar active regions, 17: 28110
RONA, V., Radiation-catalyzed chlorination of chlorinated pentane derivatives, 17: 27480
ROODA, J., Final rpt. on high-temperature materials, 1/3/62, 17: 27798 (RADC-TDR-62-307)
ROOS, Bjorn, Zirconium–O system, 17: 27817
ROQUET, J., Magnetic effects of high-altitude detonation of July 1962, 17: 27576
ROSE, John E., Radiation meter of extreme sensitivity, 17: 27706
ROSE, M. A., Impurity atoms in plasma possessing time varying electron temperature and density, 17: 28359 (CLM-R-3)
ROSE, M. E., Isospin selection rules for high-energy electron scattering, 17: 28326
ROSE, Peter H., Charged particle beam-viewing arrangement, 17: 28356
ROSENBERG, A., Influence of P-32 on tadpoles of *Rana temporaria*, 17: 27072
ROSENBERG, Leonard, Unitary impulse approximation, 17: 28193
ROSENBLATT, Gerd M., Knudsen vapor-pressure measurements on porous solids, 17: 27341
ROSENFELD, A. H., Precision-encoded memory (PEM), 17: 26949 (TID-18887)
ROSENFELD, L., Measurability of electromagnetic field quantities, 17: 27952 (UCRL-Trans-957(L))
ROSENSON, L., Precision-encoded memory (PEM), 17: 26949 (TID-18887)
ROSENZWEIG, W., Radiation dosimetry in polyethylene, 17: 27696
ROSS, K. J., Work function in tubes with cathodes of U and Zr carbides, 17: 27975
ROSSI, G., Determination of impurities in Al and SAP, 17: 27271
ROSSI, Harold H., Radiation quantities and units, 17: 27625
ROSSIKHIN, V. S., Excitation of atomic spectra in acetylene air flame, 17: 27371
ROTHERAM, M. A., Evaluation of condensed polycyclic coolant, 17: 27404 (NAA-SR-Memo-7426)
ROTHSCHILD, Mary-Louise, Gamma irradiation of alkaline solutions, 17: 27180
ROUHANI, S. Zia, Void fractions for flow of boiling D_2O, 17: 27532 (AE-106)
ROUNDS, Donald E., Study of RNA content and degree radioresistance, 17: 27060 (SAM-TDR-63-17)
ROUSE, Carl A., Ionization equilibrium equation of state. V., 17: 28112
ROUSE, Carl A., Maximum bound principal quantum number, 17: 28363 (UCRL-6981-T(Rev.I))
ROUSE, Irving, Radiocarbon. V., 17: 27581
ROWLAND, Richard H., Uptake of radioactive material from reactor by mammals at NTS, 17: 27054 (TID-18864)
ROY, D. H., Critical experiments and theory for Th–H_2O lattices, 17: 28452 (TID-7650(p.76-87))
ROY, G. M., How far can we go with BWRs?, 17: 28543
ROYER, R. A., Determination of Al by x-ray fluorescence, 17: 27260
ROZENTAL, I. L., Angular distribution of cosmic muons, 17: 28133
RUBIN, Eliezer, Prog. rpt. on foam separation, 1–3/63, 17: 28584 (RAI-113)
RUBINSTEIN, H. M., Effect of x ray on antigen metabolism in rabbit, 17: 27178
RUBY, Lawrence, Anisotropy factors for total neutron yield from D(d,n)He^3 and T(d,n)He^4, 17: 28254 (UCRL-10752(Suppl.))
RUCKENSTEIN, E., Stability of homogeneous structure of fluidized beds, 17: 27325 (AERE-Trans-942)
RUDD, M. Eugene, Electrons ejected from H and He gas by protons, 17: 28048
RUDERMAN, M. A., Infrared radiation from high-altitude explosion x rays, 17: 27573
RUFF, O., Cytologic studies of vaginal epithelium after irradiation, 17: 27097

RUGGE, Henry F., Diffusion from line source in magnetic field, 17: 28365 (UCRL-10801)
RUGH, Robert, Incidence of x-ray-induced congenital anomalies, 17: 27169
RULFS, Charles L., Coulometric determination of Tc, 17: 27249
RULFS, Charles L., Determination of small amounts of Zr. I., 17: 27298
RULFS, Charles L., Liquid-liquid extraction of pertechnetate ion, 17: 27494
RUPNIEWSKA, Zofia, Myeloid leukemia following x irradiation, 17: 27167
RUSSU, I. G., Influence of P-32 on tadpoles of *Rana temporaria*, 17: 27072
RUTENBERG, A. C., Xenon fluorides: F-19 NMR spectra, 17: 27744
RUTHERFORD, Henry A., Progr. rpt. on applications of radioisotopes to textiles, 12/60–8/61, 17: 27634 (NCSC-2477-4)
RUZICKA, Jaromir, Activation analysis separations. II., 17: 27297
RYABUKHIN, Yu. S., Radiation synthesis of stannous dibromodibutyl, 17: 27481
RYABUKHIN, Yu. S., Reactor radiation loops as large γ sources, 17: 28500

S

SACHER, George A., Late effects of continuous irradiation, 17: 27148
SACHS, Robert G., Direction of flow of time, 17: 28414
SAENGER, Eugene L., Medical aspects of radiation accidents, 17: 27632
SAGAN, Carl, Direct contact among galactic civilizations, 17: 26959
SAIGUSA, Toshifumi, Versatile Co-60 irradiation facility, 17: 27513
SAINI, Alberto, Formation of highly fluorescent Zn phosphate, 17: 27262
SAITO, Kazuo, Separation of Ir from irradiated Re, 17: 27459
SAITO, Nobufusa, Isolation of carrier-free Te from Sb, 17: 27425
SAJBEN, M., Magnetohydrodynamics of partially ionized gases, 17: 27540 (NP-12767(p.65-7))
SAKSONOV, P. P., Medico-biological factors of cosmic flights, 17: 27115
SAKURADA, Ichiro, Effects of γ radiation on polymer in solution. IV., 17: 27902
SAKURADA, Ichiro, Effects of γ radiation on polymer in solution. V., 17: 27903
SAKURADA, Ichiro, Effects of γ radiation on polymer in solution. VI., 17: 27904
SAKURAI, Akira, Heat transfer in heterogeneous water reactor. I., 17: 28496
SAKURAI, Kunitomo, Low-energy solar cosmic rays, 17: 28121
SALARIA, G. B. S., Coulometric determination of Tc, 17: 27249
SALARIA, G. B. S., Liquid-liquid extraction of pertechnetate ion, 17: 27494
SALATSKII, V. I., Investigation of $C^{13}(t,\alpha)B^{11}$ reactions, 17: 28338
SALER, B. M., Correlation of radioactivity of specimens of air, 17: 27569
SALER, B. M., Determination of apparent age of nuclear explosion, 17: 27570
SALESSE, M., Collection of He in sintering of BeO, 17: 27912
SALIYA, R. N., Probabilities of $\pi^+ \rightarrow e^+ + \nu$ and $\pi^+ \rightarrow \mu^+ + \nu$ reactions, 17: 28173
SALOVEY, R., Irradiation of polyethylene oxide and polypropylene, 17: 27914
SALOVEY, R., Radiation dosimetry in polyethylene, 17: 27696
SALTMAN, Paul, Studies in regulation of intestinal Fe absorption, 17: 27040
SALVINI, M., Instrumentation for health physics' measurements, 17: 27682 (EUR-14.i)
SAMPSON, J. B., Accurate Doppler broadened absorption, 17: 28307
SAMSONOV, G. V., Crystallochemical peculiarities of borides, nitrides, silicides, and phosphides of transition metals, 17: 27875
SAMSONOV, G. V., Silicides of Sc and Gd, 17: 27736
SAMSONOV, G. V., Sintering of nitrides of transition metals, 17: 27767
SANADZE, T. I., Paramagnetic resonance of U and Tb, 17: 27864
SANATHANAN, C. K., Transfer function synthesis as ratio of two complex polynomials, 17: 28490
SANCHO, J., Reversible and irreversible processes at Hg electrode. XVII., 17: 27328
SANDAGE, A. R., Explosion in the center of the galaxy M82, 17: 28106
SANDOMIRSKII, D. M., Effect of γ irradiation on latexes, 17: 27934
SANDRI, Guido, Dynamics of gases and plasmas, 17: 27539 (NP-12767 (p.10-12))
SANDS, Donald E., Structures of Ba_2Pb_3, BaPb, and $BaPb_3$, 17: 27808 (UCRL-7030)
SANNIER, J., Analysis of traces of C in Na, 17: 27244 (AEC-tr-5839)
SANTORO, R. P., Crystal structure of Y borates, 17: 27837
SANTSCHI, William H., Melting and casting Be, 17: 27765
SARAIYA, S. C., A-C polarography of U, 17: 27331
SARIC, Marko, Evaluation of data in personnel exposed to radiation, 17: 27620
SATAROVA, L. M., Spallation of Fe nuclei by protons, 17: 28334
SATO, Hiroshi, Characteristics of vitreous C, 17: 27735 (AEC-tr-5838)
SATO, Teruyuki, Oscillations in P.I.G. discharge, 17: 28382
SAUR, E. J., Superconducting transition of Nb,Sn-coated Nb wires, 17: 28098
SAVAGE, H. C., In-pile testing of circulating thoria suspensions, 17: 28478 (TID-7650(p.696-720))
SAVAGE, H. C., Pump loops for materials testing, 17: 27507 (ORNL-3449)
SAVENKO, I. A., Earth's radiation belts at 180-250 km, 17: 28127
SAVITSKII, E. M., Effect of temperature on mechanical properties of U, 17: 27877
SAWYER, C. D., Prog. rpt. on organic reactor coolants, 1–9/62, 17: 28441 (MITNE-29)
SAXENA, Ram Sahai, Reaction between Th and alkali molybdate, 17: 27457
SCAIFE, J. F., Radiation effects on pyridine nucleotides of thymocytes, 17: 27085
SCAIFE, J. F., Radiation effects on rat thymus mitochondria, 17: 27086
SCANDELLARI, C., Iron-59 erythrocyte incorporation in hemolytic conditions, 17: 27015
SCHAECHTER, K., Radiation effects on properties of Ni, 17: 27483
SCHANZE, U. O., Working chamber for the use of β emitters, 17: 27512
SCHATZMAN, E., Gamma astronomy, 17: 28061
SCHEIBE, H., Uranium oxide formation heats, 17: 27364
SCHEIDECKER, M., FRITTOXAL technology, nuclear applications, 17: 27757 (EUR-273.f)
SCHELL, D. C., Phase studies in $MgO–Ta_2O_5$, 17: 27834
SCHELLER, E. F., Hematological effects of x radiation, 17: 27160
SCHENK, H. L., A-c losses in hard superconductors, 17: 28099
SCHENK, M., Irradiation of graphites, 17: 27917
SCHIMMEL, W., Water-chemistry problems in water-cooled reactors, 17: 28538
SCHINTLMEISTER, J., Measurement of the decay scheme of I-131, 17: 28303
SCHIKREN, Carl Georg, Induction of temporary epilation with soft and hard radiation, 17: 27105
SCHLICH, R., Magnetic effects of high-altitude detonation of July 1962, 17: 27576
SCHLOESSER, J., Dragon core, 17: 28459 (TID-7650(p.244-52))
SCHLUEPMANN, K., Photoprotons from N-15, 17: 28294
SCHLUETER, H., Stark broadening of Balmer lines, 17: 27992
SCHMAEHL, D., Cancer production by diethylnitrosamine and x radiation, 17: 27155
SCHMIDT, A. F., Liquid-H cooling, 17: 28096
SCHMIDT, Hans-Eberhard, Electric resistance of sintered UO_2, 17: 27854
SCHMIDT, J. J., Neutron cross sections for fast reactor materials. II., 17: 28245 (KFK-120)
SCHMIDT, S., Today's radioactivity, 17: 27161
SCHMIED, H., Mechanism of chemical reactions, 17: 27330
SCHMITZ, Richard, Soft-ray tube for therapy of hemangiomas, 17: 26991
SCHMITZ, Werner, Radioiodine therapy of hyperthyroidism: dose calculation, 17: 26965
SCHNEIDER, S., Sources of positive ions for space charge neutralization, 17: 27984
SCHNEITER, Mei-chen, Determination of $CaCO_3$ moisture by radioisotope technique, 17: 27642
SCHNIZLER, Paul S., Changes associated with irradiation burnup of UO_2, 17: 27897 (WAPD-T-1501)
SCHONFELD, Ernest, Prog. rpt. on foam separation, 1–3/63, 17: 28584 (RAI-113)
SCHREINER, L., Thorotrast injury with development of hemangioendothelial sarcoma of liver, 17: 27190
SCHROEDER, E., Dragon core, 17: 28459 (TID-7650(p.244-52))
SCHROEDER, F., Prog. rpt. on Spert Project, 10–12/62, 17: 28436 (IDO-16890)
SCHUBERT, J., Elimination of radionuclides, 17: 27024
SCHUEMANN, W. C., Ionization vacuum gage, 17: 27667

SCHULER, Robert H., Energy transfer in ethane–ethylene mixtures, 17: 27406 (RRL-113)
SCHULTE, T. D., One-dimensional gas of impenetrable point-particle bosons, 17: 28181
SCHULTZ, Alvin L., Absorption of radioactive albumin from lungs of normal dogs, 17: 27041
SCHULTZ, J., Prog. rpt. on mechanical properties of reactor materials, 1–3/63, 17: 27783 (GA-4227)
SCHULTZ, Marvin A., Measurement of early uptake of I-131 by thyroid, 17: 27048
SCHULTZ, Warner W., Identifying plant and animal deficiencies by radioactive means, 17: 27310
SCHUPPLI, R., Detection of biologic action of radiation. III., 17: 27089
SCHUTT, P. F., Future of thermal breeders, 17: 28545
SCHWARZ, E., Radiation chemistry of ammonia: synthesis of hydrazine, 17: 27472
SCHWARZ, K., Tritium content in organs after irradiation, 17: 27181
SCHWARZENBERG, Leon, Secondary syndrome in allogenic marrow transplantation, 17: 26971
SCHWENKER, G., Action of ionizing radiation on drugs, 17: 27424
SCIAMA, D. W., Retarded potentials and expansion of the universe, 17: 28053
SCOTT, William D., Deformation and fracture of LiF, 17: 27839
SEAGONDOLLAR, L. W., Properties of excited states of P-31. II., 17: 28321
SEASE, J. D., Kilorod facility, ORNL, 17: 28463 (TID-7650(p.351-83))
SEB, Do In, Elastic scattering of 8.35-Bev protons on protons, 17: 28207
SEBESTIK, V., Radiation effects on erythrocytes, 17: 27166
SEDLACEK, R., Verneuil crystal growth in the arc-image furnace, 17: 27515
SEGALL, Ascher, Population exposure to background radiation, 17: 27629
SEIDEL, H., Spectra of F centers in RbCl and RbBr, 17: 27395
SEKIMOTO, Ken'ichi, Effect of γ irradiation upon wool fibers, 17: 27899
SEKIMOTO, Ken'ichi, Polymerization of styrene, methyl methacrylate, and acrylonitrile, 17: 27900
SELITSKII, Yu. A., Fission of U and Th by sub-barrier deuterons, 17: 28337
SELLEN, J. M., Jr., Oscillations in synthetic plasma beams, 17: 28394
SELZER, E., Magnetic effects of high-altitude detonation of July 1962, 17: 27576
SEMASHCO, G. L., Pole theory of Λ-hyperon production in π^--p interactions at high energies, 17: 28144 (JINR-P-1245)
SEMENOV, G. V., Hygienic significance of natural radioactivity in mining, 17: 27603 (JPRS-19866)
SEMPREBENE, L., Scintigraphy in study of metastases of thyroid adenocarcinoma, 17: 26996
SENKIN, Jean E., Bibliography on transition metal refractory carbides, 17: 27809 (UCRL-7284)
SEREBRYAKOV, V. A., Directivity of the laser output, 17: 28063
SERGEEV, N. M., Effect of γ irradiation on latexes, 17: 27934
SERIKOV, Yu. I., Anomalous radioactivity of clays, 17: 27572
SERVANT, J., Natural radioactivity in the Paris region, 17: 27567
SETLOW, R. B., Effects of uv light on thymidine dinucleotide, 17: 27079
SETLOW, R. B., Ultraviolet inactivation of DNA primer activity. I., 17: 27080
SEVERNY, A., Solar magnetic fields, 17: 28109
SHAFER, A. C., PCUT—program for recycle of power reactor fuel, 17: 28461 (TID-7650(p.285-332))
SHAFER, Janice B., Properties of ω meson from $K^- + p \rightarrow \Lambda + \omega$, 17: 28159 (UCRL-10723)
SHAFFER, Peter T. B., High-temperature forms of ZrC and TaC, 17: 27835
SHAFRANOVA, M. G., Elastic scattering of 8.35-Bev protons on protons, 17: 28207
SHAKIN, Carl, Neutron widths and strength functions, 17: 28261
SHALEK, P. D., Properties of U and Th monosulfides, 17: 27832
SHANK, Ralph C., Prog. rpt. on analytical activities, annual, 1962, 17: 27231 (IDO-14605)
SHAPIRO, A. R., Three-dimensional containment of charged particles, 17: 28396
SHAPIRO, B. S., Scavenging of methyl-d$_3$ radicals by nitric oxide, 17: 27337
SHAPPERT, L. B., Economic analysis of shipment of spent reactor fuel, 17: 28446 (ORNL-TM-590)
SHARMA, Ram Kishore, Lattice perturbed by isotope defects, 17: 28007
SHARP, David, Dynamical determination of the Regge pole parameters, 17: 28167
SHARRATT, E. W., Dissolution rates of UO_2 sintered pellets in HNO_3 systems, 17: 27338
SHARRATT, E. W., Gaseous diffusion in porous media, 17: 27860
SHATINSKII, V. M., Alpha decay of Am-241, 17: 28297
SHAVRIN, P. I., Earth's radiation belts at 180-250 km, 17: 28127
SHAW, Edward I., Laboratory experiments in radiation biology, 17: 27061 (TID-18616)
SHAW, Harlan, Electrostatic purification of He reactor-coolant, 17: 28484 (TID-18911)
SHAW, James H., Uptake of Ca-45 in calcified tissues, 17: 27039
SHEEN, E. M., In-cell β–γ monitor instruction manual, 17: 27684 (HW-67376)
SHELTON, W. T., Energy dissipation by electrons vertically incident on earth's atmosphere, 17: 28117 (AWRE-E-12/63)
SHER, N. C., Pathfinder superheated steam heat transfer, 17: 28522 (ACNP-62030)
SHERLEY, J. E., Nucleate boiling data for liquid H, 17: 28095
SHERRY, Dwyn, Analysis of teeth and bones for α-emitting elements, 17: 27172
SHEVERDINA, N. I., Radiation synthesis of stannous dibromodibutyl, 17: 27481
SHEWCHUCK, Sergey, $PdTe_2$—superconductor with CdI_2 structure, 17: 27816 (UCRL-Trans-921)
SHIBA, Koreyuki, Fission products captured in graphite. VI., 17: 27999
SHIBA, Koreyuki, Fission products captured in graphite. VII., 17: 28000
SHIBANO, H., Radiation-induced copolymerizations of olefine monomers, 17: 27476
SHIELD, E., Inelastic scattering of 166-Mev O-16 ions by Ta-181, 17: 28259 (UCRL-10825)
SHIGEMATSU, Tsunenobu, Separation of Sc from Y, 17: 27369
SHIMIZU, Akinao, Criticality calculations of one-dimensional reactors, 17: 28495
SHIMIZU, Akinao, Response matrix method, 17: 28494
SHIOMI, Naoko, Radiothermoluminescence of polyethylene, 17: 27428
SHIOMI, Naoko, Thermoluminescence from γ irradiated amino acids, 17: 27427
SHIRAKAWA, Y., X-ray-induced carcinoma simulating noma, 17: 27130
SHIROKOV, M. I., Relativistic causality in quantum mechanics of scalar particle, 17: 28141 (JINR-E-1252)
SHMIDT, V. V., Magnetization curve of superconducting alloys, 17: 28068
SHOJI, Hitoshi, Isolation of carrier-free Te from Sb, 17: 27425
SHONKA, Francis R., Radiation meter of extreme sensitivity, 17: 27706
SHOR, A. J., In-pile testing of circulating thoria suspensions, 17: 28478 (TID-7650(p.696-720))
SHORE, Ernest, Studies in regulation of intestinal Fe absorption, 17: 27040
SHORTER, R. G., Arrest of intestinal epithelial turnover by x irradiation, 17: 27103
SHRINER, Walter, Nuclear radiation detector, 17: 27711
SHUBERT, F. L., Effects of Si, N, and O on corrosion zircaloy-2, 17: 27751 (WAPD-T-1567)
SHUBIN, V. N., Method of competitive scavenger in radiation chemistry, 17: 27177
SHYU, Chen-ming, Proton electrostatic accelerator, 17: 28351
SICILIO, Fred, X irradiation of 2,2,4,6,6-pentamethylheptane, 17: 27465
SIEBENMANN, P. G., Transverse magnetoresistance of Al, 17: 27794 (NRL-5949)
SIEGEL, S., Balanced nuclear economy, 17: 28546
SILAEV, A. F., Density of high-melting powder compacts, 17: 27829
SILCOX, J., Hysteresis in hard superconductors, 17: 27993
SILTANEN, O., Gamma rays from $Al^{29}(p,\gamma)Si^{30}$ resonance, 17: 28328
SILVER, R., Nuclear generated plasmas in thermionic converters, 17: 27985
SIMON, Rene, Faults created in solids. III., 17: 27906
SIMON, S., Contamination of isotope laboratories, 17: 27614
SIMON, William G., Neutron spectra from heavy-ion bombardment of Au, 17: 28251 (UCRL-10689)
SIMONOV, Yu. A., Integral representation of square diagram, 17: 28213

SIMONS, L., Gamma rays from $Al^{29}(p,\gamma)Si^{30}$ resonance, 17: 28328
SIMPSON, E. S., Treatment and storage of radioactive wastes, 17: 28579 (EURAEC-295)
SIMS, G. E., Simulation of pool boiling heat transfer, 17: 27550
SINCLAIR, Rolf M., Equilibrium of current-carrying toroidal plasma, 17: 28392
SINCLAIR, Rolf M., Equilibrium of current-carrying toroidal plasma. II., 17: 28393
SINGER, Leon, Liquid food treating process, 17: 27223
SINGER, S. F., Geomagnetically trapped radiation, 17: 28131
SINGLETON, William J., Beta-decay branching ratio of the λ hyperon, 17: 28192
SINGRU, R. M., Polarization correlation (β-γ) in decay of Sc-46, 17: 28296
SINHA, A. P. B., Silver La ferrite, 17: 27333
SINHA, Surendra Nath, Chelate formation between Th(IV) and sulfodichlorohydroxydimethylfuchson dicarboxylic acid, 17: 27214
SIRAZHIDDINOV, N. A., Phase diagram of system $MgAl_2O_4$–$NdAlO_3$, 17: 27335
SISAKYAN, N. M., Problems in cosmic biology, 17: 27196
SIUDA, A., Bibliography on chemical effects of nuclear transformations, 17: 27421 (NP-12894)
SIZOV, I. V., Investigation of $C^{13}(t,\alpha)B^{11}$ reactions, 17: 28338
SKORYNA, Stanley C., Late effects of internal irradiation, 17: 27149
SLAT, Blanka, Toxicity of chelating agents for radiostrontium removal, 17: 27026
SLICK, William C., Study of RNA content and degree radioresistance,
SLEE, L. J., Ratio of thermal capture to fission for Pu-239, 17: 28277 17: 27060 (SAM-TDR-63-17)
SLIVKA, M. J., Cesium vapor attack on thermionic converter materials, 17: 27965
SMIRNOV, L. S., Annihilation of radiation defects in semiconductors, 17: 27928
SMIRNOVA, I. V., Radiation defects in Li-doped Si, 17: 27927
SMITH, B., Fast neutron capture in Th-232, 17: 28279
SMITH, D. C., Photography of Ar plasmas, 17: 28386
SMITH, E. E., MHD power conversion, 17: 28548
SMITH, H. F., Determination of Al by x-ray fluorescence, 17: 27260
SMITH, Joseph H., Flux to dose rate conversion factors for γ exposure, 17: 27593 (JPL-TR-32-439)
SMITH, Kenneth, Low-energy pion-pion scattering, 17: 28191
SMITH, L. H., Accumulation of Sr-89 by plants, 17: 27055
SMITH, P. F., Superconducting coil protection, 17: 27942 (NIRL/R/32)
SMITH, R. V., Choking, two-phase flow of H, 17: 28097
SMITH, Richard L., Prog. rpt. on fast wave plasma amplifier, 11/20/62, 17: 28357 (AD-290086)
SMOKE, E. J., Final rpt. on high-temperature materials, 1/3/62, 17: 27798 (RADC-TDR-62-307)
SMOLKIN, M. N., Intensity of H and deuterium lamps, 17: 28033
SMORODINSKII (SMORODINSKY), Ya., Lectures on nuclear theory, 17: 28415
SMOTRYAEV, V. A., Neutron spectrum and polarization in (d,n) reactions, 17: 28335
SNIDER, J. W., Sol gel process for preparation of thoria-base fuels, 17: 28469 (TID-7650(p.519-42))
SNIDER, R. F., Kinetic theory of moderately dense gases, 17: 28039
SNYDER, A. W., Neutron effectiveness in producing photoconductivity in dielectric materials, 17: 27893 (TID-18843)
SNYDER, H. J., Prog. rpt. on hydrazine process, 2–4/63, 17: 27414 (ASD-TR-7-840A(IX))
SNYMAN, G. C., Scattering of β particles by thick absorbers, 17: 28008
SOBELS, F. H., Evaluation of genetic radiation damage, 17: 27159
SOBELS, F. H., Forward and reverse mutation in Drosophila after exposure to mustard gas and x rays, 17: 27099
SOBUE, H., Radiation-induced copolymerizations of olefine monomers, 17: 27476
SODAN, H., Decay of 27-hour Ho-166, 17: 28291
SODAN, H., Measurement of the decay scheme of I-131, 17: 28303
SOEHLE, Sylvia, Superconducting alloys of the $Nb_3Sn_xM_{1-x}$ type, 17: 27861
SOENO, Ko, Phase change and heat treatment of U–Mn alloys, 17: 27862
SOEREMARK, Rune, Gamma analysis of elements in human mandibular compact bone, 17: 27014
SOFRONE, E., Methane radiolysis in an atomic reactor, 17: 27479
SOKOLOV, Yu. L., Concentration of 'hot' component of plasma, 17: 28376
SOKOLOV, Yu. L., Experimental studies of cosmic radiation effects on higher plants, 17: 27201
SOLBERG, K., Analog computer model dynamics of Halden-I reactor, 17: 28529 (KR-45)
SOLMITZ, Frank T., Properties of ω meson from $K^- + p \to \Lambda + \omega$, 17: 28159 (UCRL-10723)
SOLOMON, Ionel, Improvements in devices for measuring magnetic fields, 17: 27678
SOLOMON, K. A., Superconducting critical currents in wire samples, 17: 28101
SOLOV'EV, S. P., Dipole structure and internal electric fields in $PbZrO_3$, 17: 27393
SOLOV'EV, V. Ya., Deformation texture of rolled Nb, 17: 27880
SOMERS, Carolyn E., Radiation sensitization by 5-bromodeoxyuridine, 17: 27093
SOMMER, N. F., Recovery of γ-irradiated *Rhizopus stolonifer* sporangiospores, 17: 27118
SOMMERS, R. D., Use of He to provide near space environment, 17: 28075
SONDAAR, L., Thermoemissive properties of UC, 17: 27978
SOROIU, M., Contamination of vegetation by fission products, 17: 27604
SOROKIN, A. D., Polymerization of vinylidene fluoride under γ irradiation, 17: 27470
SOTNICHENKO, A. L., Titanium–Zr creep properties, 17: 27830
SOUTHWORTH, R. B., Gravitational concentration of particles in space near earth, 17: 28126
SOUYET, Francisco, Endoscopy and endophotography with Debray-Segal rectoscope, 17: 27183
SOYUZKHIMEKSPORT, V. O., Isotopes, 17: 26962
SPALDING, J. F., Characteristics of offspring from ten generations of x-irradiated male mice, 17: 27101
SPARROW, J., Geometrical reconstruction of bubble chamber tracks, 17: 27686 (NIRL/R/14)
SPECHTER, H. J., Cytologic studies of vaginal epithelium after irradiation, 17: 27097
SPEISER, David R., Possible schemes for global symmetry, 17: 28175
SPIEGLER, P., Radiation nucleation of bubbles in water, 17: 28032
SPIEWAK, Irving, Large desalinization reactor based on current technology, 17: 28499
SPINRAD, Bernard I., Nuclear reactors in space, 17: 28576
SPITSYN, A. V., Annihilation of radiation defects in semiconductors, 17: 27928
SPITSYN, Vikt. I., EPR spectrum of a hydrated electron, 17: 27435
SPITZ, Jean, Hydrocarbons from hydrolysis of mixtures of UC and UC_2, 17: 27409
SPREITER, John R., Interaction between solar wind and geomagnetic field, 17: 27574
SPRING, E., Gamma rays from $Al^{29}(p,\gamma)Si^{30}$ resonance, 17: 28328
SPURNY, K., Automatic aerosol sampler, 17: 27580
SPURWAY, A. H., Superconducting coil protection, 17: 27942 (NIRL/R/32)
SRIVASTAVA, Suresh C., Chelate formation between Th(IV) and sulfodichlorohydroxydimethylfuchson dicarboxylic acid, 17: 27214
STAHLHOFEN, W., Alpha-emitting nuclides in the human body, 17: 27285
STANDERFER, F. R., Prog. rpt. on hydrazine process, 2–4/63, 17: 27414 (ASD-TR-7-840A(IX))
STANER, P., Radioelements in soil at Mol, 17: 27602 (EURAEC-416)
STANNARD, F. Russell, Beta-decay branching ratio of the λ hyperon, 17: 28192
STARBIRD, Albert W., Effect of partitions on dose rate in multistory windowless building, 17: 27601 (TO-B-63-6)
STARODUBEV, S. V., Passage of charged particles through matter, 17: 28071
STARY, Jiri, Activation analysis separations. II., 17: 27297
STEARNS, J. Warren, Diffusion from line source in magnetic field, 17: 28365 (UCRL-10801)
STEEL, C., Prog. rpt. on Be research, annual, 1962, 17: 27777 (CW-R&DL-31)
STEEN, D. A., Prog. rpt. on two-phase flow and boiling heat transfer, 4/63, 17: 27543 (NYO-10486)
STEFFEN, R. M., Polarization correlation (β-γ) in decay of Sc-46, 17: 28296

STEHN, John R., Angular distributions in neutron-induced reactions, Z = 1 to 22 and Z = 23 to 94, 17: 28240 (BNL-400(Vols.I and II))
STEIGER, Naftali H., Charge distributions of products of reactions between complex nuclei, 17: 28253 (UCRL-10741)
STEIN, Herman J., Irradiation damage in Si, 17: 27898
STEINKOPFF, H., System U_3Si_2–UFe_2, 17: 27858
STEINMANN, O., Structure of the two-point function, 17: 28021
STEKLY, Z. J. J., Study of superconducting coil, 17: 28100
STEPHENS, F. S., Coulomb excitation of Tb-159, Ho-165, and Tm-169 with O-16 ions, 17: 28299
STEPHENS, F. S., Metastable states in Tl isotopes produced in heavy-ion reactions, 17: 28255 (UCRL-10764)
STEPNIOWSKI, Ignacy, Point air-flow counter as exo-electron detector, 17: 27688
STERN, Thomas E., Highly negative reactivity measurement, 17: 28444 (NP-12910)
STERNGLASS, E. J., Relation of prenatal radiation to cancer in childhood, 17: 27185
STERNHEIMER, R. M., Focusing of secondary beams from AGS, 17: 28347 (BNL-7120)
STEUNENBERG, R. K., Phase diagram Ca–Zn, 17: 27800 (TID-17136)
STEVENSON, M. Lynn, Properties of ω meson from $K^- + p \to \Lambda + \omega$, 17: 28159 (UCRL-10723)
STEWART, D. T., Fast scaling circuit, 17: 27660
STITT, Clyde, Studies in regulation of intestinal Fe absorption, 17: 27040
STODIEK, W., Variation of neutral density with time in C-stellarator discharges, 17: 28348 (MATT-161)
STOECKLIN, Gerhard, Phase dependence of C-11 recoil products in propane, 17: 27415 (BNL-6354)
STOERING, J. P., Suppressing photomultiplier noise, 17: 27657 (UCRL-6886(Rev.1))
STOIAN, D., Methane radiolysis in an atomic reactor, 17: 27479
STOKER, D. J., Balanced nuclear economy, 17: 28546
STOKES, R. A., Radiation-induced cyanogenation of organic liquids, 17: 27437
STOLETOV, G. D., Analysis of p-p interaction at 657 Mev. I., 17: 28147 (JINR-P-1266)
STONE, Richard S., Nuclear reactor and irradiating system, 17: 28571
STONE, W. W., TRAM for Philco 2000, 17: 28222 (KAPL-M-RPC-1(Rev.1))
STOOPS, Robert F., Phase relationships in U–C–O system, 17: 27802 (TID-18809)
STOUGHTON, R. W., Capture/fission ratio of U-233 for epithermal neutrons, 17: 28309
STRANG, V. G., Characteristics of offspring from ten generations of x-irradiated male mice, 17: 27101
STRAUSBERG, Sydney, Refabrication of sintered UO_2–fissia pellets, 17: 27764
STRICKFADEN, William B., Discharge in operating electron bombardment engine, 17: 28360 (JPL-TR-32-417)
STRIKE, Thomas A., Bone marrow megakaryocytes of irradiated guinea pigs, 17: 27073
STRINGER, T. E., Low-frequency waves in unbounded plasma, 17: 28375
STRINGFELLOW, Carl R., Jr., Formation of 1,5,7,11-tetrathiaspiro[5.5]-undecane, 17: 27412
STRIZHAK, V. I., Neutron scattering by Mg at 14 Mev, 17: 28276
STROEMNAES, Oeistein, Parasexual cycle in *Aspergillus fumigatus*, 17: 26978
STROHM, Christian, Therapy of malignant thyroid tumors, 17: 26966
STROKE, H. H., Isomer shifts in Hg-193m, Hg-194, Hg-195m, and Hg-195, 17: 28285
STROMER, Peter R., Bibliography on electroluminescence, 17: 27946 (NP-12937)
STRUTINSKII, V. M., Isomerism in the statistical model of the nucleus, 17: 28343
STUART, R. N., Application of Debye model to neutron scattering, 17: 28226 (UCRL-7267)
STUBBINS, Warren F., Hazards rpt. on University of Cincinnati Nuclear Research Center, 17: 28566 (NP-12915)
STUPEGIA, D. C., Fast neutron capture in Th-232, 17: 28279
STURCKEN, E. F., Average growth indices in U tubes containing texture gradients, 17: 27803 (TID-18815)
STUTZ, E., Cancer production by diethylnitrosamine and x radiation, 17: 27155
SUGAHARA, Tsutomu, Radiosensitivity and thyroid function in mice, 17: 27173
SUGAR, Jack, Third spectrum of Pr, 17: 27353
SUGISAKI, Ryuichi, Radioactive elements in sedimentary rocks, 17: 27579
SUITA, Tokuo, Radiation effects on electronic components, 17: 27919
SUITS, J. C., Question of superconducting Fe, 17: 28046
SUJAK, Bogdan, Point air-flow counter as exo-electric detector, 17: 27688
SUK, M., Peripheral pion-nucleon interactions, 17: 28208
SULLIVAN, A. H., Ionization chamber for estimation of biological effectiveness of radiation, 17: 27056 (CERN-63-17)
SULLIVAN, Roger D., Dynamics of gases and plasmas, 17: 27539 (NP-12767(p.10-12))
SUMNER, H. M., ERIC I. FORTRAN program for calculating resonance integrals, 17: 28238 (AEEW-M-304)
SUN, Liang-fang, Proton electrostatic accelerator, 17: 28351
SUNDARAM, A. K., A-C polarography of U, 17: 27331
SUNDERMAN, Duane N., Fission-fragment-induced stresses in ceramic materials, 17: 27888 (BMI-1635)
SUNE, N. Ortin, Application of radioisotopes to agriculture, 17: 27092
SUPEK, Z., X-radiation and 5-hydroxytryptamine content of rats and mice, 17: 27110
SUPUT, M., Effect of x radiation on soybeans, 17: 27071 (OTS-62-11755/2(p.99-100))
SURDIN, Maurice, Low reactivity measurement by sinusoidal source modulation, 17: 28489
SURIS, R. A., Scattering of slow neutrons by complex magnetic structures, 17: 28236
SUSKI, Wojciech, Ferromagnetic U monosulfide, 17: 27383
SUZUKI, Hideji, Irradiation hardening of Cu, 17: 27913
SUZUKI, Shozaburo, Effect of y irradiation on red seaweeds, 17: 27132
SVECHNIKOV, V. N., Phase diagrams for systems Cr–Nb and Cr–Nb–Ni, 17: 27825
SVECHNIKOV, V. N., Study of Cr–Nb–Ti alloys, 17: 27826
SVOBODA, Kristian, Szilard-Chalmers reaction on methyliodide, 17: 27456
SWAMI, Jnanananda, Z-dependence of pair cross section, 17: 28275
SWAMINATHAN, M. S., Sprout inhibition in irradiated potatoes, 17: 27158
SWARTZ, G. A., Wave propagation in tubular plasma, 17: 28390
SWARUP, G., Studies of ten solar active regions, 17: 28110
SWARZ, B. A., Capture/fission ratio of U-233 for epithermal neutrons, 17: 28309
SWEENEY, M. A., Prog. rpt. on radiolysis of organic fluids. Annual, 10/61–9/62, 17: 27423 (TID-18195)
SWEIG, Mitchel J., Rare decay modes of K*, 17: 28190
SWIATECKI, W. J., Equilibrium shapes of rotating charged drop and consequences for heavy-ion-induced nuclear reactions, 17: 28258 (UCRL-10775)
SWIATECKI, Wladyslaw J., Deformation energy of a charged drop. V., 17: 28262
SWINGS, P., Report on scientific interest and problems, 17: 27669
SZARVAS, T., Gas analysis of tritium, 17: 27273
SZEPKE, R., Radioactivity in foodstuffs, Poland, 1959–1961, 17: 27587 (CLOR-15)
SZILAGYI, Maria, Impurities in P-32 isotope preparation, 17: 27284
SZYMANSKI, Aleksander, Luminescence of irradiated rare gases, 17: 28011

T

TABATA, Y., Radiation-induced copolymerizations of olefine monomers, 17: 27476
TABUCHI, Akira, Fetal disturbances due to radiation, 17: 27106
TABUSHI, Masayuki, Separation of Sc from Y, 17: 27369
TAHIRA, Sadamu, Radiothermoluminescence of polyethylene, 17: 27428
TAHIRA, Sadamu, Thermoluminescence from y irradiated amino acids, 17: 27427
TAKAHASHI, Shuichiro, Activated sintering of UO_2. II., 17: 27766
TAMERS, M. A., Tritium in rain, 17: 27292
TAMIYA, Nobuo, Kinetic studies on hydrogenase, 17: 26983
TANAEVSKY, O., Natural radioactivity in the Paris region, 17: 27567
TANAKA, Eiji, Photoneutron reaction of S-32, 17: 28286
TANAKA, Osamu, Statistical analysis of fast neutron total cross sections,

17: 28287
TANAKA, Tetsuro, Irradiated triglycine sulfate dielectric behaviors, 17: 27916
TANAKA, Yuji, Characteristic of P.I.G. discharge tube, 17: 28380
TARSKI, Jan, Possible schemes for global symmetry, 17: 28175
TARUSOV, B. N., Fundamental processes of radiation injuries, 17: 27195
TASSAN, S., Cadmium ratios of U-235 fission, 17: 28135
TAUB, Stephen R., Genetic control of mating type differentiation in paramecium, 17: 26979
TAUBE, M., Fused Pu and U chlorides as fuel for fast breeder reactors, 17: 27797 (PAN-414/V)
TAULLI, T. A., Determination of orthophosphate with cerous ion, 17: 27258
TAYLOR, D. M., Metabolism of Sr and Ba in the rat, 17: 27029
TAYLOR, R. F., Dissolution rates of UO_2 sintered pellets in HNO_3 systems, 17: 27338
TEITEL, Robert J., Liquid metal breeder reactor, 17: 28458 (TID-7650 (p.210-43))
TELLER, Edward, Plowshare, 17: 26958
TEPLEY, Lee R., Magnetic storm of September 30, 1961, 17: 27577
TERAZAWA, Toshio, Electrolytic separation factor of H isotopes, 17: 27716
TEREKHOVA, V. F., Effect of temperature on mechanical properties of U, 17: 27877
TERLETSKII, Ya. P., Unified classification of elementary particles, 17: 28206
TETENYI, P., Radiation effects on properties of Ni, 17: 27483
THACKRAY, Malcolm, Opening irradiated silica ampoules, 17: 27213
THALER, R. M., Nonlocal nucleon-nucleon interaction, 17: 28187
THAYER, Rollin H., Tritium for determination of estrogen in tissues of broilers fed 3,4-dianisyl-2-t-3-hexene, 17: 27050
THIBAULT, Robert J., Absorption bands of CO_2, 17: 27361
THIEBAUX, Martial L., Jr., Pion production in pion-pion collisions, 17: 28189
THOMAS, C., Cancer production by diethylnitrosamine and x radiation, 17: 27155
THOMAS, E. W., Charge transfer and ionization by positive ions, 17: 28054
THOMAS, G., Defects in Al quenched from liquid state, 17: 27806 (TID-18876)
THOMAS, P. M., Atomic number effects in electron probe microanalysis, 17: 27268
THOMPSON, M. G., Characteristics of neon–alcohol spark chamber, 17: 27697
THOMPSON, Robert N., Prog. rpt. on sequestration of metal ions in brine using radioisotopes. Final, 1962, 17: 27320 (ORO-602)
THOMPSON, V. R., Prog. rpt. on refractory alloys, 4/15/61–11/15/62, 17: 27812 (WADD-TR-61-134(Pt.II))
THORN, R. J., Thermodynamic study of Th–O system, 17: 27799 (TID-17092)
THORNE, A. C., Protective equipment for decontamination systems, 17: 27624
THROWER, P. A., Microstructural changes in neutron-irradiated graphite, 17: 27910
TIMMERHAUS, K. D., Conference on cryogenic engineering, UCLA, 8/62, 17: 28072
TIMMERHAUS, K. D., Thermal conductivity of solid H_2O and D_2O, 17: 28082
TKACHENKO, A. A., Two-photon annihilation of polarized electrons and positrons, 17: 28214
TOBE, T., Action of ionizing radiations on biological systems, 17: 27131
TOBRINER, M. W., Prog. rpt. on radiolysis of organic fluids. Annual, 10/61–9/62, 17: 27423 (TID-18195)
TODD, R., Stability of homogeneous structure of fluidized beds, 17: 27325 (AERE-Trans-942)
TOIVANEN, Timo, Solution of group diffusion equations, 17: 28031
TOLCHENKOV, D. L., Neutron spectrum and polarization in (d,n) reactions, 17: 28335
TOMIC-KAROVIC, K., Effect of acidophilus milk on guinea pigs exposed to x rays, 17: 27082
TOMIC-KAROVIC, K., Influence of acidophilus milk on young of guinea-pigs irradiated with x rays, 17: 27083
TOMIOKA, Hideo, Radiation effects on electronic components, 17: 27919
TOMLIN, D. H., Self-diffusion in Mo, 17: 27868
TOMLINSON, W. J., III, Isomer shifts in Hg-193m, Hg-194, Hg-195m, and Hg-195, 17: 28285
TONGIORGI, E., Natural tracing by seasonal variation of $^{18}O/^{16}O$ ratio in a ground water research, 17: 27565 (RT/GEO(63)-25)
TONOLLI, V., Fission products from fallout in lake biota, 17: 27588 (CNI-109)
TOROPOV, N. A., Phase diagram of system $MgAl_2O_4$–$NdAlO_3$, 17: 27335
TORSOLI, A., Pulmonary metastases from thyroid carcinoma, 17: 26998
TOSELLI, F., ECO—critical experiment for study of ORGEL lattice, 17: 28427 (EUR-130.f)
TOUSSAINT, C., Determination of impurities in SAP, 17: 27226 (EUR-21.f)
TOWELL, R. H., Prog. rpt. on effect of rod spacing on heat transfer burnout, 12/62–2/63, 17: 28422 (DPST-63-69-3)
TOWELL, R. H., Prog. rpt. on effect of rod spacing on heat transfer burnout, 3–5/63, 17: 28423 (DPST-63-69-6)
TOWER, L. T., Regeneration of sublimating thermionic components, 17: 27968
TOWLE, Leland H., Economic benefits from Civilian Nuclear Power Program, 17: 28532 (SRIA-65)
TOWLER, O. A., Jr., Thorium irradiation in D_2O-moderated reactors, 17: 28474 (TID-7650(p.614-29))
TOYODA, Koichi, Irradiated triglycine sulfate dielectric behaviors, 17: 27916
TRAMEZZANI, J. H., Effect of storage on I-131 solutions, 17: 27247
TRASSATTI, S., Titanium nitrides as electrodes in Redox system, 17: 27346
TRET'YAKOVA, S. P., Half life of spontaneously fissionable isomer, 17: 28241 (JINR-P-1258)
TRIVEDI, J. C., Continuous Co-60 irradiation, 17: 27123
TRKA, Z., Inelastic π^--p interactions at 7 Bev, 17: 28205
TROSTIN, I. S., Neutron spectrum and polarization in (d,n) reactions, 17: 28335
TROTTER, J., Soft x ray $L_{2,3}$ emission spectrum from liquid Al, 17: 27865
TROZERA, T. A., Prog. rpt. on mechanical properties of reactor materials, 1–3/63, 17: 27783 (GA-4227)
TRUBEY, D. K., CDC-1604 subroutine package for making linear, logarithmic, and semilogarithmic graphs, 17: 27723 (ORNL-3447)
TRUELSEN, T. A., Radiation pasteurization of fresh fruits and vegetables, 17: 27096
TRUSOV, L. P., Refinement of Cr–Mo–V steel by Ce, 17: 27859
TRZEBIATOWSKI, Wlodzimierz, Ferromagnetic U monosulfide, 17: 27383
TSCHIRNE, G., Adsorption investigations in nitrate fuses, 17: 27500
TSETLIN, B. L., Radiation polymerization on solid base layers, 17: 27482
TSIEN, K. C., Depth dose tables for medium-energy x rays, 17: 27633
TSIKORA, I. L., Excitation of atomic spectra in acetylene air flame, 17: 27371
TSIPENYUK, E. V., Radiation effects on rubber–plastic systems, 17: 27931
TSIVOGLOU, Ernest C., Radioactivity standards for water, 17: 27613
TSU, T. C., MHD power conversion, 17: 28548
TSUCHIYA, Takehiko, Radiosensitivity and thyroid function in mice, 17: 27173
TSUJI, Kozo, Reaction between polymer radical and 1,1-diphenyl-2-picryl hydrazyl, 17: 27215
TSUKADA, Kinso, Statistical analysis of fast neutron total cross sections, 17: 28287
TSUKAMOTO, William T., Gamma irradiation of alkaline solutions, 17: 27180
TSUMURA, Akiko, Exchange reaction between NH_3 and D, 17: 27386
TUCKER, P. A., Phase equilibria for NaF–BeF_2–UF_4, 17: 27336
TUECKE, J. E., TRAM for Philco 2000, 17: 28222 (KAPL-M-RPC-1(Rev.1))
TULLY, G. R., Jr., Pore structure of graphite as affected by impregnation processes, 17: 27782 (GA-3194)
TUNA, Naip, Analysis and purification of commercial radioiodinated triolein, 17: 26984
TURCHETTI, G., Diagnosis of genital tumors with radioisotopes, 17: 26995
TURCHETTI, Giovanni, Cervical incorporation of P-32 in diagnosis of cancer of uterine cervix, 17: 26968

17: 27225 (AERE-R-4295)
TURNER, Frederick B., Uptake of radioactive material from reactor by mammals at NTS, 17: 27054 (TID-18864)
TURNER, J. J., Krypton fluoride: preparation, 17: 27743
TURSKA, E., Kinetics of graft copolymerization on preirradiated polymethyl methacrylate, 17: 27449
TURSKA, E., Radiation produced peroxides of polymethylmethacrylate, 17: 27475
TYLKINA, M. A., Effect of temperature on mechanical properties of U, 17: 27877
TYMCHYN, H. L., Chloride stress corrosion cracking of Ni–Cr–Fe alloys, 17: 27749 (KAPL-M-CC-3)

U

UEDA, Tomiko, Deuterium exchange of benzene with D_2O, 17: 27384
UEDA, Tomiko, Deuterium exchange reaction of p-xylene and anisole with D_2O, 17: 27387
UGAJIN, Hiroaki, Enrichment of D_2O by exchange, 17: 27388
ULLMANN, J. W., Thorium fuel cycle irradiation program. 17: 28476 (TID-7650(p.643-74))
ULRICH, A. J., Thermionic energy conversion diode, 17: 27988
UMEZU, Masahiko, Determination of B in graphite, 17: 27286
UNDERWOOD, Robin Arthur, Thermocouple arrangements for reactor fuel elements, 17: 28512
UPHOFF, Delta E., Irradiation protection by bone marrow. III., 17: 27206
UPHOFF, Delta E., Irradiation protection by bone marrow. IV., 17: 27207
UPOR, Endre, Determination of Th using arsenazo III, 17: 27246
URETSKY, Jack L., Low-energy pion-pion scattering, 17: 28191
UROSEVIC, Vladeta, Physical parameters of a γ-absorption densitometer, 17: 27707
URUBAY, S., Anion exchange of U and Th in ketone media, 17: 27503
URUBAY, S., Anion exchange of U, Th, Fe, and Al in acid–ether solutions, 17: 27296
UYEKI, E. M., Phosphatase activity in bone-marrow transplantation, 17: 27111

V

VALAT, Jean, Highly negative reactivity measurement, 17: 28444 (NP-12910)
VALAT, Jean, Low reactivity measurement by sinusoidal source modulation, 17: 28489
VALFELLS, Agust, Methods of and apparatus for generating electrical energy, 17: 28103
VAN ALLEN, J. A., Charged-particle observations in outer magnetosphere, 17: 28123
VAN CLEAVE, Charles D., Irradiation and the nervous system, 17: 27194
VAN DER LINDEN, M. F., Use of radioisotopes and radiations, 17: 27641
VAN DE VOORDE, N., Treatment and storage of radioactive wastes, 17: 28579 (EURAEC-295)
VAN LANCKER, J. L., Molecular nature of cellular radiosensitivity, 17: 27140
VANNIKOV, A. V., Effect of I on electrical properties of polyethylene, 17: 27434
VAN REEN, Robert, Nutrition of 96 naval recruits during a shelter habitability study, 17: 27612
VANYUKOV, M. P., Directivity of the laser output, 17: 28063
VAREKAMP, P., Nondestructive analysis of fuel elements containing U-235, 17: 27229 (EUR-248.f)
VARSAVSKY, Carlos M., Prog. rpt. on photo processes and collisions of 5 times ionized O, 3–5/63, 17: 27948 (TID-18921)
VAS'KOVSKAYA, M. A., Radiation effects on rubber–plastic systems, 17: 27931
VASSEUR, A., Analysis of traces of C in Na, 17: 27244 (AEC-tr-5839)
VAUGHAN, W. H., Optical transmission of LiF, 17: 27354
VAVILOV, V. S., Radiation defects in Li-doped Si, 17: 27927
VEIT, W., Luminous compounds activated with Pm-147, 17: 27619
VELLETRI, Joseph D., Effect of partitions on dose rate in multistory windowless building, 17: 27601 (TO-B-63-6)
VENEVTSEV, Yu. N., Dipole structure and internal electric fields in $PbZrO_3$, 17: 27393
VENUTI, G. Campos, Absorption of π^- mesons in complex nuclei, 17: 28139 (ISS-63/28(p.1-11))
VERBEETEN, B., Megavolt therapy and the cancer patient, 17: 27000
VERESHCHINSKII, I. V., Radiation synthesis of stannous dibromodibutyl, 17: 27481
VERKHOGLYADOVA, T. S., Silicides of Sc and Gd, 17: 27736
VERKHOGLYADOVA, T. S., Sintering of nitrides of transition metals, 17: 27767
VERMEULEN, Theodore, Longitudinal dispersion in packed extraction columns, 17: 27544 (UCRL-10696)
VERMEULEN, Theodore, Longitudinal dispersion in two-phase continuous-flow operations, 17: 27545
VERNOV, S. N., Earth's radiation belts at 180-250 km, 17: 28127
VERTUT, Jean, Pivot mountings for remote controls, 17: 27522
VESELY, V., Sorption on zirconyl phosphate, 17: 27351
VIGDERGAUS, V. Sh., Kinetics of dispersion of some refractory materials, 17: 27873
VIGDOROVICH, V. N., Method of measuring microhardness, 17: 27874
VIGNAU, H., Isomeric states of Y-90, 17: 28327
VIKTORA, L., Radiation effects on erythrocytes, 17: 27166
VILLANI, R., Radioisotopic methods in diagnosis of intracranial tumors, 17: 26994
VINH MAU, Nicole, Excited levels of C-12 and O* levels of O-16, 17: 28264
VITTORIO, P. V., Chromium-51 content of liver nucleic acids, 17: 27084
VOLKOVA, E. V., Polymerization of vinylidene fluoride under γ irradiation, 17: 27470
VOLODER, Kato, Effect of chelating agents on renal retention of U, 17: 27025
VOLTA, G., Power excursion reactor, 17: 28563 (EUR-271.i)
VOLYNKIN, Yu. M., Medico-biological factors of cosmic flights, 17: 27115
VON GLAHN, Uwe H., Critical boiling heat flux for channels of various cross sections, 17: 27537 (NASA-TN-D-1656)
VON GUTFELD, R. J., Switching speed of superconducting Sn, 17: 28045
VON HERZEN, M., Superconductivity in the In–Sn system, 17: 28047
VON KISS, M., Thermal conductivity of powders, 17: 27368
VOROB'EV, V. S., Energy emitted in spectral lines by plasma, 17: 28385
VOROZHTSOV, B. I., Radiation effects on insulating materials. V., 17: 27907
VOROZHTSOVA, I. G., Radiation effects on insulating materials. V., 17: 27907
VORWALD, Arthur J., Humoral transport of Be, 17: 27045
VOS, G., Determination of impurities in SAP, 17: 27226 (EUR-21.f)
VOS, G., Determination of Fe, Ni, and Cr traces in polyphenyls, 17: 27227 (EUR-28.f)
VOS, G., Determination of Ba, Nb, Sr, Fe, Mn, and Zn in carbonatites, 17: 27228 (EUR-32.f)
VOUK, V. B., Effect of chelating agents on renal retention of U, 17: 27025
VOUK, V. G., Methods for determination of atmospheric radioactivity, 17: 27568
VRTEL, Jaroslav, Steels containing B for nuclear technique, 17: 28493
VUCCINO, Simone, EMIA-1 alpha pulse chamber, 17: 27693
VYAZANKINA, M. A., Radiation effects on rubber–plastic systems, 17: 27931

W

WACHTLER, F., Radiation reactions and lesions in the eye, 17: 27186
WACHTMAN, J. B., Jr., Relaxation in ThO_2 containing CaO, 17: 27869
WAGENER, H. H., Detection of biologic action of radiation. III., 17: 27089
WAGNER, H., Functional method for condensed systems, 17: 28201
WAGNER, K., Formation of Fe-59 from Co-59 by neutrons, 17: 28292
WAHLIN, L., Colutron, zero deflection isotope separator, 17: 27714 (UCOL P-516)
WAIGHT, E. S., Polymerization of methacrylamide and N-arylmethacrylamides, 17: 27448
WAKDNIG-VAARTAJA, Rose, Chromosome size and radiosensitivity, 17: 27153
WAKUTA, Yoshihisa, Low frequency H vibrations in KH_2PO_4, 17: 27359
WALKER, E. A., Metallurgically stable Mg–Zr alloys, 17: 27848
WALKER, R. M., Ternary fission of heavy compound nuclei, 17: 28257

(UCRL-10772)
WALLACE, Bruce, Overdominance of induced mutations, 17: 26977
WALLIS, G. B., Prog. rpt. on two-phase flow and boiling heat transfer, 4/63, 17: 27543 (NYO-10486)
WALTHALL, F. G., Strontium-87 as index of geologic processes, 17: 27582
WALWICK, E. R., Inhibition of thymidine kinase–DNA polymerase activity in kidney by x radiation, 17: 27066 (USNRDL-TR-640)
WANG, Bi-cheng, Cathodic action of metal complexes at dropping Hg electrode. VI., 17: 27340
WARD, C. H., Determination of traces of nitride N in Na, 17: 27232 (LA-2892)
WARNKE, D. F., Radiation effects on lead zirconate titanate ferroelectrics, 17: 27894 (TID-18856)
WARREN, I. H., Reduction of uranyl carbonate to UO_2, 17: 27339
WARSCHAUER, Douglas M., Energy storage device, 17: 28104
WASA, Kiyotaka, Radiation effects on electronic components, 17: 27919
WASHBURN, T. H., Fabrication of sol-gel thoria–urania, 17: 28473 (TID-7650(p.606-13))
WATANABE, H. T., Prog. rpt. on hydrazine process, 2–4/63, 17: 27414 (ASD-TR-7-840A(IX))
WATSON, B. W., Digital dosimeter for use in x-ray therapy, 17: 27164
WATSON, C. D., Aqueous processing in Th fuels, 17: 28464 (TID-7650 (p.384-435))
WATSON, D. G., Radioecological studies of northern Alaska, 17: 27053 (HW-SA-3050)
WATSON, R. H., Reaction of H with Zr–Ti alloy, 17: 27347
WATSON, W. K. R., Three-dimensional containment of charged particles, 17: 28396
WATSON-MUNRO, C. N., Hydromagnetic wave propagation near ion cyclotron resonance, 17: 28391
WATT, D. A., Production of magnetic fields by superconductors, 17: 27936 (AERE-M-1207)
WATT, William, Carbon articles, 17: 27771
WATT, William, Cementing process for carbon articles, 17: 27770
WATT, William, Treatment of C and graphite articles, 17: 27884
WATT, William, Tubular carbon articles, 17: 27772
WEBBER, W. R., Time variations of low rigidity cosmic rays, 17: 28130
WEBER, C. W., Continuous photometric fluorine analyzer, 17: 27251
WEBER, J. W., Fission gas yield in U, 17: 27416 (HW-73394)
WEBER, O., Effect of chelating agents on renal retention of U, 17: 27025
WEBER, O., Toxicity of chelating agents for radiostrontium removal, 17: 27026
WEECH, M. E., Boron permits larger reprocessing vessels, 17: 27502
WEGMANN, Werner, Thyroid sarcoma after irradiation in adulthood, 17: 27184
WEGNER, H. E., Fission fragment response in semiconductor detectors, 17: 27702
WEGRZYNOWICZ, Z., Fibrinolytic activity in radiation in dogs, 17: 27212
WEGST, Walter Frederick, Jr., Wavelength-dependent effects of x rays on mammalian tissue cells, 17: 27057 (MMPP-196-2)
WEHMEYER, D. B., Thermal activation method for ρ_{28} measurements in enriched UO_2 lattices, 17: 28419 (BAW-1268)
WEIDENBAUM, B., Prog. rpt. on high-performance UO_2 program, 4–6/62, 17: 28429 (GEAP-3771-5)
WEIL, Louis, Improvements in low-temperature irradiation, 17: 28570
WEILL-BOUSSON, M., Sarcoma of liver and hepatic thorotrastosis, 17: 27081
WEINBERG, A. F., Interdiffusion between reactor fuels and thermionic emitters, 17: 27961
WEINBERG, A. F., Thermionic cathode systems for fission-heat conversion, 17: 27960
WEINER, E. R., Hydrazine formation in radiolysis of NH_3, 17: 27436
WEINSTEIN, S., Neutron absorption rates in lumped poisons, 17: 28244 (KAPL-M-SW-2)
WEISMAN, Joel, Gas handling systems for radioactive gases, 17: 28517
WEISS, Rainer, Stark effect and hyperfine structure of HF, 17: 27378
WEISZ, Gideon, Magnetic breakdown in Mg, 17: 27870
WELBER, B., Viscosity of liquid He-3, 17: 28036
WELLS, T. C., Creep of Mg–Zr alloy ZA, 17: 27849
WENDT, G., Gamma rays from $Al^{29}(p,\gamma)Si^{30}$ resonance, 17: 28328
WENTWORTH, R. C., Magnetic storm of September 30, 1961, 17: 27577
WERNER, L., Decay of 27-hour Ho-166, 17: 28291
WERTHEIM, G. K., High velocity drive for Mossbauer experiments, 17: 27665
WEST, G. B., Accurate Doppler broadened absorption, 17: 28307
WESTBROCK, A. J., Liquid He supply systems for space simulators, 17: 28078
WESTGREN, R. C., Prog. rpt. on refractory alloys, 4/15/61–11/15/62, 17: 27812 (WADD-TR-61-134(Pt.II))
WHEATFALL, Walter, Prog. rpt. on Ti-modified $NbAl_3$, 3–5/63, 17: 27780 (DRI-2104)
WHEATLEY, John C., Prog. rpt. on properties of materials at low temperatures, final, 6/58–5/62, 17: 27804 (TID-18842)
WHIPPEY, P. W., Electron spin resonance in irradiated diamond, 17: 27918
WHITE, Donald H., Capture-γ determination of Cr-54 structure, 17: 28320
WHITE, J. L., Prog. rpt. on mechanical properties of reactor materials, 1–3/63, 17: 27783 (GA-4227)
WHITE, Laura F., Photometric determination of U by H_2O_2 method, 17: 27269
WHITEHEAD, E., Reaction of H with Zr–Ti alloy, 17: 27347
WHITEHEAD, J. D., Density of the atmosphere in the E-region, 17: 28051
WHITEMAN, A. S., Charge transfer and ionization by positive ions, 17: 28054
WHITEMAN, P. C., Relative turgidity and β-radiation absorption, 17: 26969
WHITFIELD, W. J., Dust-controlled vented hood, 17: 27600 (SC-4905(RR))
WHITTEN, R. C., Three-particle scattering. I. Planar case, 17: 28177
WHITTINGHILL, Maurice, Prog. rpt. on mutation in chromosomes of irradiated *Drosophila melanogaster*, final, 2/54–3/63, 17: 27064 (TID-18855)
WIENEKE, Antonnette A., Incorporation of radioactive P in leucocyte, 17: 27028
WIERNIK, G., Arrest of intestinal epithelial turnover by x irradiation, 17: 27103
WIGHT, E. W., Chromium-51 content of liver nucleic acids, 17: 27084
WILCOX, John M., Hydromagnetic wave propagation near ion cyclotron resonance, 17: 28391
WILCOX, W. W., Inducer-impeller for liquid H, 17: 28093
WILKING, S., Many-quantum processes in two-state systems, 17: 28202
WILKING, S., Perturbation theory approximation for random times, 17: 28203
WILKINS, Bruce, Total reaction cross sections for heavy ions, 17: 28216 (UCRL-10766)
WILKINS, D. E., Silage density measured by γ attenuation, 17: 27645
WILKINS, R., Recombination rates in a shock tube, 17: 27373
WILKS, J., Viscosity of liquid He-3, 17: 28036
WILLENBRINK, J., Assay of radiochromatograms by scintillation counting, 17: 27275
WILLENS, R. H., Defects in Al quenched from liquid state, 17: 27806 (TID-18876)
WILLIAMS, Frederick, Prog. rpt. on radiological mechanisms for geophysical research, annual, 1962, 17: 27564 (NYO-10219)
WILLIAMS, R. O., Liquid-gas film calorimeter for deformation of metals, 17: 27663
WILLIAMS, Robert E., 1-Deuterio pentaborane rearrangement, 17: 27410
WILLIAMS, W. E., MHD flow in a rectangular tube, 17: 28015
WILLIAMSON, Stanley M., Heat formation of XeF_4, 17: 27321 (UCRL-7298-T)
WILLIS, B. T. M., Neutron diffraction studies of the actinide oxides. I., 17: 27381
WILLIS, B. T. M., Neutron diffraction studies of the actinide oxides. II., 17: 27382
WILSDORF, H. G. F., Dislocation behavior of strained f.c.c. metals, 17: 27842
WILSON, Archie S., Computer programs for indexing x-ray diffraction powder patterns. I., 17: 27720 (HW-SA-2756)
WILSON, G. L., Relative turgidity and β-radiation absorption, 17: 26969
WILSON, H. W., Mass spectrometry of solids, 17: 27278
WILSON, J. G., Progress in elementary particle and cosmic ray physics. VI., 17: 28128
WILSON, R. W., Disk component of galactic radio radiation, 17: 28107
WINDSOR, Alfred A., D-c transformer with low noise and wide frequency response, 17: 27658 (UCRL-10473)
WINDSOR, H., JEEPNIK—exponential facility, 17: 28564 (KR-46)
WINOCUR, Joseph, Diffusion from line source in magnetic field, 17: 28365 (UCRL-10801)
WINSTON, A., Modification of wood with polymers formed by radiation,

17: 27896 (TID-18907)
WINTERBERG, Friedwart, Hydromagnetic waves in inhomogeneous magnetic fields, 17: 27995
WISKEMANN, Arthur, Radiation hazard in treatment of skin diseases with Ra-224, 17: 27608
WITTENBERG, L. J., Phase equilibria for $NaF-BeF_2-UF_4$, 17: 27336
WITTENBERG, L. J., Prog. rpt. on reactor fuels and materials, 1–3/63, 17: 27789 (MLM-1156)
WOHLFROM, Merlis, Incidence of x-ray-induced congenital anomalies, 17: 27169
WOLF, Alfred P., Phase dependence of C-11 recoil products in propane, 17: 27415 (BNL-6354)
WOLF, Gerd, Time-resolution of proportional counters for x rays, 17: 27709
WOLF, H. C., Spectra of F centers in RbCl and RbBr, 17: 27395
WOLF, J., Calculation of the ρ trajectory, 17: 28145 (JINR-P-1246)
WOLFENDALE, A. W., Characteristics of neon–alcohol spark chamber, 17: 27697
WOLGAST, R. C., Superconducting critical currents in wire samples, 17: 28101
WOOD, D. F., Determination of B in Zr, Hf, and Ti, 17: 27265
WOOD, David H., Structures of Ba_2Pb_3, BaPb, and $BaPb_3$, 17: 27808 (UCRL-7030)
WOODIN, A. M., Incorporation of radioactive P in leucocyte, 17: 27028
WOODS, E. J., Canonical commutation relations describing nonrelativistic infinite free Bose gas, 17: 28179
WOOLFENDEN, B. K., Closed-cycle He refrigerator for 2.5°K, 17: 28080
WOOTEN, Frederick, Seebeck coefficient of CsAu, 17: 27872
WORDSWORTH, A. D., Nuclear fuel handling, 17: 28501
WORKMAN, J. B., Magnetohydrodynamics of partially ionized gases, 17: 27540 (NP-12767(p.65-7))
WORMAN, F. C. V., Integral γ and neutron measurements on Kiwi-B-4A, 17: 28572 (LA-2885)
WOUTHUYSEN, S. A., Progress in elementary particle and cosmic ray physics. VI., 17: 28128
WRIGHT, D. A., Ettingshausen cooling in pyrolytic graphite, 17: 27820
WRIGHT, D. A., Uranium carbide as thermionic emitter, 17: 27969
WRIGHT, J. H., MHD power conversion, 17: 28548
WRONSKI, A. S., Stage III recovery in neutron-irradiated Mo, 17: 27922
WYDE, S. S., Sr., Prog. rpt. on heat rejection in nuclear space powerplants, 12/62–2/63, 17: 28574 (PWA-2197)

Y

YAGI, Kohsuke, Experiment on $O^{18}(p,\gamma)F^{19}$ reaction, 17: 28290
YAGLE, R. A., Tests on models of nuclear reactor elements. I., 17: 28445 (NP-12925)
YAJIMA, Seishi, Fission products captured in graphite. VI., 17: 27999
YAJIMA, Seishi, Fission products captured in graphite. VII., 17: 28000
YAKIMENKO, V. L., Absorption of waves in a plasma, 17: 28399
YAKOVLEV, B. S., Relaxation polarization in saturated hydrocarbons, 17: 27469
YAMABE, Shotaro, Reactions (α,p) on light and medium-weight nuclei, 17: 28288
YAMADA, Keihiko, Characteristics of vitreous C, 17: 27735 (AEC-tr-5838)
YAMAGISHI, Shigeru, Determination of Hf in Zr, 17: 27289
YAMAGISHI, Shigeru, Determination of Al by double activation analysis, 17: 27290
YAMAMOTO, Albert S., Prog. rpt. on determination of Nb-rich region of ternary phase diagrams, 17: 27779 (DRI-2102)
YAMAMOTO, Katsumi, Uranyl tropolone-5-sulfonic acid chelate, 17: 27288
YAMAMOTO, Kozuo, Activated sintering of UO_2. II., 17: 27766
YAMAMOTO, Kenzo, Characteristic of P.I.G. discharge tube, 17: 28380
YAMANOUCHI, Mikio, Yield of photodeuterons from Ni, Cu, Sn, and Sb, 17: 28289
YAMAZAKI, Takashi, Reactions (α,p) on light and medium-weight nuclei, 17: 28288
YAMAZAKI, Toshimitsu, Separation of Ir from irradiated Re, 17: 27459
YANG, L., Interdiffusion between reactor fuels and thermionic emitters, 17: 27961
YANG, L., Thermionic cathode systems for fission-heat conversion, 17: 27960
YANKO, W. H., Prog. rpt. on organic coolants, 1–3/63, 17: 28433 (IDO-11005)
YASHCHENKO, M. L., Determination of alkali metals, 17: 27243 (AEC-tr-5822)
YAZDOVSKII, V. I., Problems in cosmic biology, 17: 27196
YEH, Hsi-jung (Si-jung), Preparation of carrier-free S-35, 17: 28271
YEH, Hsi-jung (Si-jung), Preparation of carrier-free P-32, 17: 28272
YEH, Ming-hen, Proton electrostatic accelerator, 17: 28351
YEN, Peter K-J., Uptake of Ca-45 in calcified tissues, 17: 27039
YNTEMA, J. L., Reaction (d,p) on Ti isotopes, 17: 28323
YOKOYAMA, Yuji, Isolation of carrier-free Te from Sb, 17: 27425
YORKE, B. A., Nuclear resonance spectra of electrolyte solutions, 17: 27365
YOSHIDA, Hiroshi, Radiothermoluminescence of polyethylene, 17: 27428
YOSHIDA, Hiroshi, Reaction between polymer radical and 1,1-diphenyl-2-picryl hydrazyl, 17: 27215
YOSHIKAWA, Shoichi, Equilibrium of current-carrying toroidal plasma, 17: 28392
YOSHIKAWA, Shoichi, Equilibrium of current-carrying toroidal plasma. II., 17: 28393
YOSHINAGA, Haruno, Fetal disturbances due to radiation, 17: 27106
YOSHIZAWA, Shiro, Production of high-purity artificial graphite, 17: 27742
YOSHIZAWA, Shiro, Purification of raw coke for high-purity artificial graphite, 17: 27741
YOSIM, S. J., Electrical conductivities of molten Bi–BiI, solutions, 17: 27318 (NAA-SR-8086)
YOUNG, Harold D., EGCR operational refueling, 17: 28497
YURKEVICH, V. G., Effect of γ irradiation on latexes, 17: 27934

Z

ZABETAKIS, M. G., Hazards in handling of cryogenic fluids, 17: 28081
ZACHARIASEN, W. H., Crystal structure of alpha Pu metal, 17: 27787 (LADC-5523)
ZACHARIASEN, W. H., Monoclinic powder x-ray-diffraction patterns of Pu, 17: 27786 (LADC-5522)
ZACUTTI, A., Diagnosis of genital tumors with radioisotopes, 17: 26995
ZACUTTI, Alberto, Cervical incorporation of P-32 in diagnosis of cancer of uterine cervix, 17: 26968
ZAMOTRINSKAYA, E. A., Effects of γ radiation on EPR in $CuSO_4 \cdot 5H_2O$, 17: 27439
ZAORALEK, P., Tritium content in organs after irradiation, 17: 27181
ZAVYALOV, O. I., Spectral representations in perturbation theory, 17: 28209
ZAWADZKI, A., High energy-photon-initiated E.A.S., 17: 28119 (PAN-382/VI)
ZEITZ, K., Closed-cycle He refrigerator for 2.5°K, 17: 28080
ZELENKOV, A. G., Alpha decay of Am-241, 17: 28297
ZEMAN, Adolf, Activation analysis separations. II., 17: 27297
ZEMANY, Paul D., Production of x-ray spectra, 17: 27242 (TID-18925)
ZERWEKH, A., Determination of traces of nitride N in Na, 17: 27232 (LA-2892)
ZHDANOV, G. S., Dipole structure and internal electric fields in $PbZrO_3$, 17: 27393
ZHITKEVICH, V. F., Excitation of atomic spectra in acetylene air flame, 17: 27371
ZHURKO, V. A., Radiation effects on rubber–plastic systems, 17: 27931
ZIEGLER, Charles A., Prog. rpt. on radiological mechanisms for geophysical research, annual, 1962, 17: 27564 (NYO-10219)
ZIEGLER, Charles A., Radioisotope techniques for atmospheric density measurements, 17: 27656 (NYO-9854)
ZIEGLER, W. T., Thermodynamic properties of parahydrogen, 17: 28076
ZIMMERMAN, A. M., Effects of D_2O on eggs of *Arbacia punctulata*, 17: 26975
ZIRIN, Harold, Coronal observations and rocket solar uv results, 17: 28105
ZIRZ, Janos, Reaction $\pi^- + p \rightarrow \pi^- + \pi^+ + n$ below 800 Mev, 17: 28158 (UCRL-10720)
ZOLLFRANK, L., Measuring of compounds labeled with C-14, 17: 27453
ZOLLWEG, R. J., Evaporation of Mo in Cs vapor, 17: 27967
ZOLLWEG, R. J., Thermal conductivity of Cs vapor, 17: 27957
ZOLOTOV, Yu. A., Chemistry of Np(V), 17: 27350
ZOLOTOV, Yu. A., Extraction of Pu, 17: 27305
ZOLOTOV, Yu. A., Separation of Np-239, 17: 27446

ZONA, Rinaldo, Testing of equipment and mechanical components, 17: 28488
ZORZOLI, G. B., Two-group theory model, 17: 28231
ZSEBOEK, Z., Radiobiological reactions at the subcellular level, 17: 27134
ZUCAL, Raquel H., Dialkyl phosphorodithioic acids in liquid extraction systems, 17: 27407
ZUL'KARNEEV, R., Meson production in pp collisions at 660 Mev, 17: 28140 (JINR-D-1236)
ZUMWALT, L. R., Fission-product release from UC_2 particles, 17: 27784 (GA-4267)
ZUPPINGER, A., Considerations in tissue radiosensitivity, 17: 27139
ZUPPINGER, A., Tritium content in organs after irradiation, 17: 27181
ZURAKOWSKA-ORSZAGH, J., Radiation effects on polyamid films, 17: 27933
ZWANZIGER, Daniel, Unstable particles in S-matrix theory, 17: 28195
ZWEIFEL, P. F., Theorems for neutron transport equation, 17: 28225 (TID-18885)

SUBJECT INDEX

Main entries in this index are generally specific materials, things, and processes. These are followed by modifiers that describe the properties of, and processes applied to, the main entries. A more complete description of the patterns and style of indexing used is included in the introductions to the subject index cumulations that are issued quarterly.

As an aid to the users of this index, references to report numbers, where appropriate, are included after the abstract number of the citation.

The number preceding the colon is the *NSA* volume number, and the number following is the abstract number in that volume. The designation (R) following the abstract number indicates that the abstract is of a progress report; (P) indicates a patent; and (T) indicates a translation. Abstracts for reports other than progress reports carry no letter designation. Published literature (journal article or book) is identifiable by the absence of a report number.

A

ABDOMEN
radiation effects on rabbit, irritating, 17: 27070(T) (JPRS-19806)
ABSTRACTS
on superconducting magnets, 17: 27936 (AERE-M-1207)
ACCELERATORS
beam measurement and viewing, apparatus for, 17: 28356(P)
book: *Building Constructions for Accelerators*, 17: 28353
magnetic fields in, ideal polar surfaces for weak or strong focusing, 17: 28350
ACETALDEHYDE
formation by radiolysis of propenediol in air and nitrogen, 17: 27424
ACETIC ACID
chelates of, toxic effects on rats, 17: 27026
ACETIC ACID, BUTYL ESTER
butyl acetate-thiocyanate, solvent properties for scandium, 17: 27369
butyl acetate-2,4-pentanedione, solvent properties for scandium, 17: 27369
butyl acetate-1,3-diphenyl,1,3-propanedione, solvent properties for scandium, 17: 27369
ACETIC ACID, [(CARBOXYMETHYLIMINO)BIS(ETHYLENENITRILO)] TETRA-
effects on retention of uranyl nitrate by rat kidneys, 17: 27025
use for elimination of plutonium-239 in man, 17: 27208
ACETIC ACID, (ETHYLENEDIAMINE)TETRA-
protective effects of, against toxicity of 2,2'-dichloro-*N*-methyldiethylamine, 17: 27030
toxic effects on rats, 17: 27026
use in sequestration of metal ions in brines, 17: 27320(R) (ORO-602)
ACETIC ACID, VINYL ESTER
radioinduced graft polymerization on polyvinyl alcohol in aqueous and acetylated solutions, 17: 27444
radioinduced graft polymerization on polymethyl methacrylate, 17: 27449
radioinduced polymerization at −40 to 25°C, kinetics of, 17: 27471
radioinduced polymerization of solid, 17: 27484
ACETIC ACID, VINYL ESTER POLYMERS
preparation and isotope-exchange properties of tritium-labeled, 17: 27413
ACETONE
formation by radiolysis of propenediol in air and nitrogen, 17: 27424
ACETONE, THENOYLTRIFLUORO-
benzene-thenoyltrifluoroacetone, solvent properties for scandium, 17: 27369
ACRYLIC ACID POLYMERS
radioinduced gelation of aqueous solutions of, effects of salt on, 17: 27902
radioinduced intramolecular crosslinking of aqueous solutions of, effects of salt on, 17: 27903
ACRYLONITRILE
grafting to acetates and cotton, post-irradiation, 17: 27634(R) (NCSC-2477-4)
radioinduced graft polymerization to acetate, cotton, and triacetate, effects of oxygen on, 17: 27634(R) (NCSC-2477-4)
radioinduced graft polymerization on wool, 17: 27900
radioinduced polymerization in *N,N*-dimethylformamide, effects of ferric chloride on, 17: 27467
radioinduced polymerization of solid, 17: 27484
ACTINIUM ISOTOPES Ac-223
separation from protactinium using arsenazo III and isoamyl alcohol, radiometric, 17: 27306
ACTINIUM ISOTOPES Ac-227
separation of daughters from, by paper electrophoresis in high electric fields, 17: 27445
ACTIVATION ANALYSIS
of biological materials, 17: 26963 (EUR-128.i)
of bone for trace elements, 17: 27014
of metabolites after injection of stable isotopes, 17: 26985
sensitivity and uses of, review of, 17: 27241 (TID-18908)
technique for opening irradiated silica ampoules, 17: 27213
techniques using neutron reactions other than (n,γ), review, 17: 27230 (IA-839)
use for analysis of coal, 17: 27240(R) (TID-18883)
use in determining plant element deficiencies, 17: 27310(P)
ADHESIVES
performance under simulated space conditions, 17: 27506 (NP-12906)
ADVANCED EPITHERMAL THORIUM REACTOR
design concepts, 17: 28455 (TID-7650(p.148-71))
AERIAL SURVEYING
of high-intensity radiation field of small area, 17: 26945 (CEX-62.6.2)
AEROSOLS
analysis of radioactive, by electron microscopy and nuclear emulsion studies, 17: 27644
detection of submicroscopic, by activation using radon decay products, 17: 27643
flow of gas-solid, in experimental loop, 17: 27541(R) (TID-18909)
flow of gas-solid, in experimental loop, 17: 27542(R) (TID-18910)
radioactive, sampler for collection of atmospheric, 17: 27580
AFRICA
uranium market in, in 1962, 17: 26952
AGE ESTIMATION
method of, using rhenium, 17: 27566(T) (AEC-tr-5858)
survey of 1963 data from radiocarbon techniques for, 17: 27581

AGING
effects on chromosome aberrations in regenerating liver, 17: 27176
AGRICULTURE
radioisotopes in studies of, review, 17: 27092
silage density measurement by gamma ray attenuation, 17: 27645
AIR
analysis for strontium-90, samples collected in 1962, 17: 27592(R) (HASL-138)
separation of iodine from, design of equipment for, 17: 28579 (EURAEC-295)
ALANINE, PHENYL-
radioinduced thermoluminescence in, 17: 27427
ALASKA
fallout monitoring in Northern, 1961–62, 17: 27053 (HW-SA-3050)
ALBUMINS
sorption from lungs, tracer study, 17: 27041
use of iodine-131-labeled human serum, for tumor localization in man and rats, 17: 26992
use of iodine-131-labeled serum, for diagnosis of cervical and ovarian tumors, 17: 26995
ALGAE
radiation effects on, in space flight, 17: 27197
radiation injuries, restoration by interaction, 17: 27095
ALKALI METAL HALIDE CRYSTALS
spectra of divalent samarium in, 17: 27372(T)
ALKALI METALS
determination of, method for, 17: 27243(T) (AEC-tr-5822)
electron interactions in, electrical and thermal conductivity effects of, 17: 27923
heat transfer research on, 17: 27535 (BNL-801)
partition coefficients and reciprocal ionic radii, 17: 27562 (INSJ-54)
separation from thorium using liquid-metal extraction, 17: 28465 (TID-7650(p.436-53))
ALKALINE EARTH METALS
alloying effects of, book on, 17: 27881
book: *Separation of Similar Rare Metals*, 17: 27401
partition coefficients and reciprocal ionic radii, 17: 27562 (INSJ-54)
separation from thorium using liquid-metal extraction, 17: 28465 (TID-7650(p.436-53))
ALLOYS
book: *Effects of Impurities and Rare Earth Elements on Properties of Alloys*, 17: 27881
evaluation for reactor uses, 17: 27730(R) (HW-77052)
magnetization curves of superconducting, 17: 28068
mechanical properties of dispersion-strengthened, 17: 27882
melting of, engineering drawings of furnace for, 17: 27517
ALPHA PARTICLES
contribution in lung cancer induction, 17: 27622
detection and measurement in bone ashes, scintillation method for, 17: 27285
luminescence of rare gases induced by, in an electric field, 17: 28011
reactions (α,p) with nuclei $10 \leq A \leq 59$ at 22 Mev, angular distributions from, 17: 28288
reactions with cesium iodide crystals, comparison with activator saturation model for scintillation efficiency from, 17: 27463
reactions with cesium iodide crystals; emission spectra and self-trapped holes in scintillations from, 17: 27464
yields in oxygen-16 reactions at 167 Mev, 17: 28252 (UCRL-10693)
ALPHA SPECTRA
use in studying anodic oxidation of metals, 17: 27753
ALUMINUM
additive effects on oxidation of niobium and zirconium beryllides at 650 to 1000°C, 17: 27781(R) (DRI-2105)
alloying effects on properties of boron steel, 17: 28493
analysis for impurities, spectrographic, 17: 27271
argon-41 and xenon-133 ranges in, at 0.5 kev–2.25 Mev, 17: 28001
argon-41, krypton-85, and xenon-133 ranges and retention at 1–150 kev, energy and flux dependence of, 17: 28002
carbon-12 and oxygen-16 reactions with, total cross sections for, 17: 28256 (UCRL-10766)
corrosion by water, effects of high velocity on, 17: 27730(R) (HW-77052)
defects in, formation of, on quenching from liquid state, 17: 27806 (TID-18876)
determination as impurity in bismuth, spectrographic, 17: 27309
determination, double activation, 17: 27290
determination in Magnox AL-80, volumetric, 17: 27237 (PG-Report-454)
determination in organo-aluminum compounds, x-ray fluoroscopic, 17: 27260
magnetic resistance of, transverse, 17: 27794 (NRL-5949)
neutron scattering cross sections in, fast, 17: 28437 (KAPL-2000-20)
oxidation of, use of alpha spectroscopy in studying anodic, 17: 27753
oxygen-16 reactions at 167 Mev, charged-particle yields in, 17: 28252 (UCRL-10693)
partition coefficients and reciprocal ionic radii, 17: 27562 (INSJ-54)
photon reactions with, proton angular distributions and yields at >8 Mev, 17: 28265
preparation of kryptonated, by high-pressure diffusion, 17: 27639(R) (TID-18881)
proton scattering at 730 Mev, differential cross sections and polarizations for, 17: 28157 (UCRL-10637)
reactor criticality effects, 17: 28437 (KAPL-2000-20)
separation of uranium from, by anion exchange, 17: 27296
stresses in, feasibility of infrared detection of, 17: 27508 (SCTM-59-63(25))
wetting behavior of liquid, on solid beryllium, effects of atmosphere and temperature on, 17: 27795 (ORNL-3438)
wetting by hydrogen, contact angle for, 17: 28083
x-ray emission from liquid, spectra of soft L, 17: 27865
ALUMINUM ALLOYS
corrosion of 1245 and X-8001 by water, groove pitting in, 17: 27747 (HW-74359(Rev.))
critical temperature of superconducting, impurity effects on, 17: 28044
gamma emission from thermal neutron activation of types 5052 and 6061, 17: 27889 (EUR-103.f)
radiation effects on tensile properties at cryogenic temperature, neutron, 17: 28102
Al–Be–Mn, determination of $AlMnBe_4$ in commercially pure beryllium, 17: 27856
Al–Cu, atomic number effects correction in electron probe microanalysis of, 17: 27268
Al–Fe–Ni, corrosion by water at 330°C, 17: 27730(R) (HW-77052)
Al–Mg, fatigue properties at 200 to 500°C, 17: 27847
Al–Nb–Sn, superconducting properties of Nb_3SnAl, 17: 27861
Al–Nb–Sn–Ti, oxidation by air at 760 to 1360°C, 17: 27780(R) (DRI-2104)
Al–Nb–Zr, hardness, 17: 27779(R) (DRI-2102)
Al–Ni–Nb, crystal structure of intermetallic compounds, 17: 27828
Al–Ni–Nb, reactions between Ni_3Al and Ni_3Nb in, 17: 27827
Al–Ni–Pu, fabrication by pneumatic injection casting, 17: 27758 (HW-69204)
Al–U, atomic number effects correction in electron probe microanalysis of, 17: 27268
Al–Zr, atomic number effects correction in electron probe microanalysis of, 17: 27268
ALUMINUM COMPACTS
fabrication and properties of Frittoxal, 17: 27757 (EUR-273.f)
ALUMINUM COMPOUNDS
analysis of reactive organo-, for aluminum, 17: 27260
isopropoxide, infrared spectra, 17: 27727 (ASD-TDR-63-322)
synthesis of organic tin-aluminum polymers, 17: 27221(P)
ALUMINUM CRYSTALS
dislocation pinning by di-vacancies and vacancies, 17: 27805(R) (TID-18859)
ALUMINUM ISOTOPES Al-25
energy levels of, spin of 3.70-Mev, 17: 28266
ALUMINUM ISOTOPES Al-27
neutron activation rates for, fast, 17: 28221(EUR-107.f)
neutron reactions (n,γ) with, properties as resonance neutron detector, 17: 28237 (AE-102)
neutron reactions (n,p) with, properties for neutron threshold detectors, 17: 28237 (AE-102)
proton reactions (p,γ) at 980–1030 kev, gamma spectra from 992-kev resonance in, 17: 28328

reactions with neon-20, collision effects in, 17: 28258 (UCRL-10775)
ALUMINUM NITRATES
polymerization effects on tetravalent plutonium in acid media, 17: 27319 (ORNL-TM-585)
ALUMINUM NITRIDES
hardness of single crystals of, micro-, 17: 27343
ALUMINUM OXIDE COATINGS
compatibility with uranium dioxide, 17: 26944(R) (BMI-1630(Del.))
ALUMINUM OXIDE COMPACTS
corrosion by cesium vapor, 17: 27965
ALUMINUM OXIDE POWDERS
thermal conductivity, 17: 27368
ALUMINUM OXIDES
compatibility with graphite, 17: 26944(R) (BMI-1630(Del.))
electron tunneling in, between superconducting lead and tin, 17: 28037
ion exchange properties of, in nitrate melts, 17: 27500
luminescence of, electric-field-induced, 17: 27342
properties of, dispersion velocity dependence on mechanical and thermal, 17: 27873
radioinduced stresses in, from fission fragment bombardment, 17: 27888 (BMI-1635)
reactions with graphite, mechanism for, 17: 27344
Al_2O_3–$CoMoO_4$, catalytic effects on hydrocracking of high boilers in reactor coolant, 17: 28435 (IDO-16877)
Al_2O_3–Ni, catalytic effects on isotope exchange between anisole or xylene and deuterium oxide, 17: 27387
Al_2O_3–NiO_2, catalytic effects on hydrocracking of high boilers in reactor coolant, 17: 28435 (IDO-16877)
Al_2O_3–Pt, catalytic effects on hydrocracking of high boilers in reactor coolant, 17: 28435 (IDO-16877)
Al_2O_3–SiO_2–Na_2O, ion exchange properties of, in nitrate melts, 17: 27500
ALUMINUM SYSTEMS
Al–Nb–Si–Ti, oxidation by air at 760 to 1360°C, 17: 27780(R) (DRI-2104)
Al–U_3O_8, fabrication of, exothermic chemical reactions in, 17: 27807(R) (TID-18891)
AMERICIUM ISOTOPES Am-241
alpha decay of, fine structure in spectra for, 17: 28297
AMERICIUM(V) OXIDE IONS
properties of, comparison to neptunium, plutonium, and uranium, 17: 27350
AMIDE POLYMERS
radiation effects on physical properties of, 17: 27634(R) (NCSC-2477-4)
radiation effects on photoconductivity decay of Nylon, 17: 27895 (TID-18857)
radiation effects on fibers and films of, gamma, 17: 27933
AMINES
metabolism of, effects of, on radiosensitivity of animals, 17: 27047
AMINO ACIDS
metabolism of, effects of, on radiosensitivity of animals, 17: 27047
radiosensitivity in pearls, 17: 27901
radiosensitivity in solution and proteinase, 17: 27429
AMMONIA
deuterium enrichment of, method for, 17: 27718(P)
heat of formation, 17: 27322 (UCRL-7301-T)
isotope exchange with deuterium, effects of nickel on, 17: 27386
preparation of, isotope effects of deuterium in presence of iron catalyst on, 17: 27385
radiolysis by deuterons, mechanism of hydrazine formation in, 17: 27436
radiolysis of, kinetics of hydrazine formation in, 17: 27472
NH_3–benzene, formation of aniline in radiolysis of, 17: 27472
AMMONIUM ACETATES
radiolysis of aqueous solutions of, formation of aspartic acid and glycine in, 17: 27473
AMMONIUM COMPOUNDS, QUATERNARY
solvent properties of methyltricaprylammonium chloride for technetium, 17: 27494
AMMONIUM THIOCYANATES
analytical use for spectrophotometric determination of ruthenium, 17: 27287
solvent properties for ruthenium, 17: 27460
AMPLIFIERS
circuit design of pre-, for transparent beam-current monitors, 17: 27687 (NIRL/R/30)
design of fast-wave plasma cyclotron, 17: 27650(R) (AD-297382)
research on fast-wave plasma cyclotron, 17: 28357(R) (AD-290086)
AMYLOSES
radiation effects on, electron spin resonance investigations of gamma, 17: 27454
ANILINE
formation of, in radiolysis of ammonia-benzene mixtures, kinetics of, 17: 27472
ANIMAL CELLS
fate of Ehrlich's ascites, injected into portal system of mice, 17: 26974
radiation effects on, wavelength-dependent, 17: 27057 (MMPP-196-2)
radiation effects on proteins in, 17: 27134
radiation effects on, time-intensity factors in, 17: 27144
radiosensitivity, effects of mitotic phase, 17: 27152
radiosensitivity, effects of ribonucleic acid content in tissue cultures, 17: 27060 (SAN-TDR-63-17)
radiosensitivity in tissue culture, effects of 5-bromodesoxyuridine, 17: 27093
radiosensitivity of chromosomes in different phases of mitosis, 17: 27168
radiosensitivity of rapidly dividing, 17: 27138
ANIMAL METABOLISM
tracer studies in domestic animals, tracer study, 17: 27636 (NP-12929)
tracer studies in domestic animals, bibliography, 17: 27635 (NP-12928)
ANIMAL REPRODUCTION
radiation effects in rats, chronic, low-level gamma exposure, 17: 27170
radiation effects in mammals, 17: 27090
ANIMALS
monitoring for fallout in, in Northern Alaska, 1961–62, 17: 27053 (HW-SA-3050)
radiation effects on, cosmic, 17: 27196
radiation effects on, in space flight, 17: 27197
radiosensitivity of, effects of metabolism on, 17: 27047
ANION EXCHANGE MATERIALS
sorptive properties of Dowex 1 for aluminum, iron, thorium, and uranium, 17: 27296
ANISOLE
isotope exchange with deuterium oxide, effects of catalysts on, 17: 27387
ANP REACTORS
decontamination of, engineering drawings of, facility for, 17: 27520
ANTHRACENE
fluorescence of naphthalene-containing, characteristic of, 17: 27451
ANTIBODIES
radiation effects on response to antigen, 17: 27178
radiation effects on formation of influenza virus-, in mice, 17: 27123
radioinduced stimulation of formation of, mechanism, 17: 27121
reactions to tumor homografts, 17: 26987
ANTIGENS
radiation effects on antibody response, 17: 27178
radiation effects on response, 17: 27121
ANTIMONY
determination as impurity in bismuth, spectrographic, 17: 27309
photon reactions (γ,d) and (γ,p) at 24 Mev, yield ratios for, 17: 28289
separation of tellurium from proton-irradiated, 17: 27425
spectra in reaction zone of acetylene air flame, excitation of atomic, 17: 27371(T)
ANTIMONY ALLOYS
In–Sb, electron and hole mobility in, 17: 27831
Sb–Nb–Sn, superconducting properties of Nb_3SnSb, 17: 27861
ANTIMONY ISOTOPES Sb-124
determination as impurity in phosphorus-32 by sorption in humus column, 17: 27284
ANTIMONY ISOTOPES Sb-127
yield in uranium fission, ratio to antimony-129, 17: 28278
ANTIMONY ISOTOPES Sb-129
yield in uranium fission, ratio to antimony-127, 17: 28278
ANTINUCLEONS
interactions with nucleons, resonance model of, 17: 28197

ANTIPYRINE
analytical use for photometric determination of cerium, 17: 27304
derivatives of, synthesis of, 17: 27304
ARABINOSE
radiation effects on, electron spin resonance investigations of gamma, 17: 27454
ARCHEOLOGICAL SPECIMENS
age estimations of, survey of 1963 data on, 17: 27581
ARCO CHEMICAL PLANT
analytical procedures for, 17: 27231(R) (IDO-14605)
ARGON
determination in atmosphere in relation to nitrogen using radiation attenuation gage, 17: 27564(R) (NYO-10219)
electron density in plasma of, gas laser as infrared interferometer for measuring, 17: 28367
electron diffusion in plasmas of, in magnetic fields, 17: 27650(R) (AD-297382)
ion reactions in gases of, charge transfer and ionization cross sections for 60–450 kev rare-gas, 17: 28054
plasma motion and structure of, in rail spark gap, 17: 28395
plasma of, photographic techniques for dynamics of, 17: 28386
scintillation response of liquid, to protons up to 50 Mev, 17: 28059
ultraviolet refractive indices of gaseous, Cherenkov radiation method for vacuum, 17: 28028
ultraviolet refractive indices of gaseous, Rayleigh scattering method for vacuum, 17: 28029
ARGON IONS
reactions in rare gases at 60–450 kev, charge transfer and ionization cross sections for, 17: 28054
reactions with copper, gold, and nickel foils at 100 ev, dislocation dipoles and loops from, 17: 27920
reactions with heavy compound nuclei, ternary-fission, 17: 28257 (UCRL-10772)
ARGON ISOTOPES Ar-41
range and retention in metals at 1–150 kev, energy and flux dependence of, 17: 28002
ranges in aluminum at 0.7 kev–2.25 Mev, 17: 28001
ARMY REACTORS (ML-1)
development and operation of, Jan.–Mar. 1963, 17: 28528(R) (IDO-28607)
ARSENIC ISOTOPES As-73
energy levels of, double isomerism in, 17: 28319
ARSENIC ISOTOPES As-75
proton reactions (p,pn) at 130 to 250 Mev with, cross sections for, 17: 28247(R) (TID-18788)
ARSENIC OXIDES
additive effects on pulse height of quartz phosphors, 17: 27701
ARSINE
heat of formation, 17: 27322 (UCRL-7301-T)
ASPARTIC ACID
formation in radiolysis of aqueous solutions of ammonium acetate, 17: 27473
radioinduced deamination in aqueous solution, 17: 27431
ATMOSPHERE
analysis for argon–nitrogen ratio in, using two-source radiation attenuation gage, 17: 27564(R) (NYO-10219)
auroral arcs in mid-latitudes of, excitation mechanisms for stable 6300 Å, 17: 28052
cosmic electron energy dissipation in vertically incident, 17: 28117 (AWRE-E-12/63)
density of, radioisotope techniques for measuring, 17: 27656 (NYO-9854)
radioactive aerosols in, sampler for collection of, 17: 27580
radioactivity at Sljeme and in Zagreb, Yugoslavia, Feb. to May 1962, 17: 27569
radioactivity in, methods for determining, 17: 27568
radiological monitoring for lead-212 over Mexico City, 17: 27628
ATOMIC ENERGY
bibliography of bibliographies on, Apr. and May 1963, 17: 26948 (TID-3717)
bibliography on publications of LASL research from 1957 to 1962, 17: 26946 (LAMS-2895)
ATOMIC EXPLOSIONS
applications of peaceful, survey, 17: 26958
bibliography, 17: 27937 (AID-62-155)
determination of apparent age of, 17: 27570
thermal effects on materials at various burst heights and atmospheric conditions, 17: 27945 (NP-12936)
uses for generating heat and power, 17: 27505 (EUR-16.f)
uses in excavations, review, 17: 27504 (EUR-7.f)
ATOMIC MODELS
for ionization transients in cesium, 17: 28043
ATOMS
excited states of, lifetimes of, 17: 27943 (NP-12903)
meson (μ^-) capture in K shells of, angular correlations from, 17: 28215
spectra of, isotopic shifts in, 17: 27396
AUDITORY ORGANS
radiation effects on elastic fibers in, of rabbit, 17: 27133
AURORAL STORMS
bibliography, 17: 27937 (AID-62-155)
production of, trapped ion mechanism for, 17: 28125
radiation from, conference on, 17: 27563 (NP-12932)

B

BACTEREMIA
occurrence in irradiated rats, 17: 27074
BACTERIA
effects of staphylococcal leukocidin on phosphorus metabolism in leukocytes, tracer study, 17: 27028
hydrogenase reactions in *Clostridium pasteurianum* and *Proteus vulgaris*, 17: 26983
radiation effects on infection of intestine in dogs by, 17: 27204
radiation effects on protein synthesis in *Bacterium cadaveris*, 17: 27109
radiation effects on DNA in *Escherichia freundii* in culture, effect of chemical content of medium on, 17: 27113
BARIUM
determination in carbonatites, spectrographic, 17: 27228 (EUR-32.f)
diffusion from single-crystal uranium carbide, 17: 27784 (GA-4267)
metabolism in rats, tracer study, 17: 27029
partition coefficients and reciprocal ionic radii, 17: 27562 (INSJ-54)
spectra in reaction zone of acetylene air flame, excitation of atomic, 17: 27371(T)
BARIUM ALLOYS
Ba–Ni, performance of thermionic cell with cathode of, 17: 27981
Ba–Pb, crystal structure of $BaPb$, $BaPb_3$, and Ba_3Pb_5 in, 17: 27808 (UCRL-7030)
BARIUM BORIDES
electron structure and physical properties of crystals of, 17: 27875
BARIUM ISOTOPES Ba-133
decay of, cesium-133 spin assignments and transition polarities from electron-capture, 17: 28267
BARIUM ISOTOPES Ba-140
content in vegetation in Italy, 1961, 17: 27591 (EUR-223.i)
BARIUM OXIDES
additive effects on thermal conductivity of uranium dioxide, 17: 27814(T) (EURAEC-103)
performance of thermionic cell with cathode of, 17: 27981
BARIUM SULFATES
effects on shielding properties of cements and concretes, 17: 27930
BARLEY
absorptive properties of, for cesium in competition with other cations, 17: 27031
growth inhibition of, grown on mash prepared from irradiated potatoes, 17: 27158
strontium-89 accumulation in grain, stems, and leaves, genetic factors in, 17: 27055
BEARING MATERIALS
performance under simulated space conditions, 17: 27506 (NP-12906)
BEARINGS
coatings for liquid metal, performance of, 17: 27535 (BNL-801)
design and performance of gas-lubricated, for use in high speed turbomachinery, 17: 27510(R) (TID-18924)
development of liquid-metal lubricated, 17: 27535 (BNL-801)

BEHAVIOR
radiation avoidance, role of ozone in mice, 17: 27175
BELGIUM
geology of Mol site, for waste disposal, 17: 28579 (EURAEC-295)
radioelement movement in soil at Mol, 17: 27602(T) (EURAEC-416)
BENZENE
analytical use in tritium determination in rain, 17: 27292
hydrogen isotope exchange with deuterium oxide, effects of nickel on, 17: 27384
isotope exchange with deuterium, effects on nickel and platinum on, 17: 27389
solvent properties for terphenyls, 17: 27423(R) (TID-18195)
benzene-*m*-terphenyl, radiolysis of deuterated and normal products in, 17: 27418 (IDO-16876)
benzene-2,4-pentanedione, solvent properties for scandium, 17: 27369
benzene-thenoyltrifluoroacetone, solvent properties for scandium, 17: 27369
benzene-1,3-diphenyl, 1,3-propanedione, solvent properties for scandium, 17: 27369
NH_2-benzene, formation of aniline in radiolysis of, 17: 27472
BENZENE, ETHYL-
hydrogen isotope exchange with deuterium oxide, effects of nickel on, 17: 27384
BENZENE, ETHYNYL-
radioinduced polymerization with vinyl monomers, kinetics of, 17: 27477
BENZENE, 1,2,4-TRIPHENYL-
formation in radiolysis of deuterated and normal benzene–*m*-terphenyl, 17: 27418 (IDO-16876)
BENZENE, 1,3,5-TRIPHENYL-
formation in radiolysis of deuterated and normal benzene–*m*-terphenyl, 17: 27418 (IDO-16876)
BERYLLIUM
analysis for ternary $AlMnBe_6$ phases in commercially pure, 17: 27856
detection, spot test for, 17: 27261
electron correlation energies in atomic, 17: 28049
fabrication by melting and casting, techniques for, 17: 27765
hardness and lattice parameters of high-purity, 17: 27853
mechanical properties of rods and tubes of, 17: 27777(R) (CW-R&DL-31)
polishing of, method for chemical, 17: 27745(P)
proton scattering at 730 Mev, differential cross sections and polarizations for, 17: 28157 (UCRL-10637)
radiation effects on sintered, helium bubble formation in, 17: 27912
radiation effects in STPR, effects of geometry on, 17: 27423(R) (TID-18195)
toxic effects of, terminology for, 17: 27616
transport in body fluids, 17: 27045
wetting behavior of liquid metals and alloys on solid, 17: 27795 (ORNL-3438)
xenon-133 ranges and retention at 1–150 kev, energy and flux dependence of, 17: 28002
BERYLLIUM ALLOYS
Al–Be–Mn, determination of $AlMnBe_6$ in commercially pure beryllium, 17: 27856
Be–Fe, heat treatment for improved properties of, 17: 27883(P)
Be–Nb, oxidation of aluminum-containing $NbBe_{12}$ and Nb_2Be_{17} at 650 to 1000°C, 17: 27781(R) (DRI-2105)
Be–Pd, wetting behavior of liquid, on solid beryllium, effects of atmosphere and temperature on, 17: 27795 (ORNL-3438)
Be–Th–U, compatibility with niobium, tantalum, and zirconium, 17: 26944(R) (BMI-1630(Del.))
Be–Th–U, compression fracture strength, 17: 26944(R) (BMI-1630(Del.))
Be–Ti, wetting behavior of liquid, on solid beryllium, effects of atmosphere and temperature on, 17: 27795 (ORNL-3438)
Be–Zr, oxidation of aluminum-containing $ZrBe_{13}$ and Zr_2Be_{17} at 650 to 1000°C, 17: 27781(R) (DRI-2105)
Be–Zr, wetting behavior of liquid, on solid beryllium, effects of atmosphere and temperature on, 17: 27795 (ORNL-3438)
BERYLLIUM COMPOUNDS
toxic effects of, terminology for, 17: 27616
BERYLLIUM CRYSTALS
resistance ratios and tensile properties of zone-refined, 17: 27733(R) (NMI-2116)
BERYLLIUM FLUORIDES
BeF_2–NaF–UF_4, phase diagram, 17: 27336
BERYLLIUM IONS
electron affinities of, relativistic and nonrelativistic, 17: 27996
BERYLLIUM OXIDE COATINGS
compatibility with uranium dioxide, 17: 26944(R) (BMI-1630(Del.))
BERYLLIUM OXIDE COMPACTS
texture of hot-pressed, nature and strength of, 17: 27850
BERYLLIUM OXIDE CRYSTALS
hardness of, micro-, 17: 27343
BERYLLIUM OXIDES
determination in ores, photometric, 17: 27302
radioinduced stresses in, from fission fragment bombardment, 17: 27888 (BMI-1635)
reactions with graphite, mechanism for, 17: 27344
BeO–CeO_2, phase studies, 17: 27833
BeO–MgO, phase studies, 17: 27833
BeO–MgO–ZrO_2, phase studies, 17: 27833
BeO–ZrO_2, phase studies, 17: 27833
BETA PARTICLES
absorption by plant tissues, estimation of water status from, 17: 26969
detection and measurement of, design of scintillation monitor for low-level in-cell, 17: 27684 (HW-67376)
detection and measurement, vise-configuration counter for, 17: 27694
detection and measurement of, design of apparatus for, 17: 27283
detection and measurement of activity of, in rabbits and rodents from reactor test (Kiwi-A) at Nevada Test Site, 17: 27054 (TID-18864)
pathological effects on pituitary from implanted yttrium-90, 17: 27191
scattering by thick absorbers, backscattering spectra from, 17: 28008
sorption of, as function of atomic number, 17: 28184
BIBLIOGRAPHIES
on activation analysis with neutron reactions other than (n,γ), 17: 27230 (IA-839)
on bibliographies of atomic energy literature, Apr. and May 1963, 17: 26948 (TID-3717)
on chemical effects of nuclear transformations, 17: 27421 (NP-12894)
on civilian application releases of Sandia Corp., 17: 26947 (SCR-600)
on controlled thermonuclear research and plasma physics, 17: 28361 (NP-12921)
on determining oxygen content of materials, 17: 27293
on electroluminescence, 17: 27946 (NP-12937)
on existence of two neutrinos, 17: 28152 (NEVIS-113)
on fused plutonium and uranium chlorides as fuel for fast breeder reactors, 17: 27797 (PAN-414/V)
on gas-liquid chromatography, 17: 27272
on heats of dissociation of gaseous chlorides, 17: 27315 (LA-2841)
on literature examined by Radiation Shielding Information Center at ORNL, 17: 28409 (ORNL-RSIC-1)
on mass spectrometry of solids, 17: 27278
on nuclear medicine, 17: 27067 (WP/22/5)
on osmium and ruthenium, 17: 27400
on particle and radiation behavior in ionosphere, plasmas, and space, 17: 27937 (AID-62-155)
on plasma shock waves, 17: 28402
on Plowshare Project, 17: 26958
on properties of refractory carbides, 17: 27809 (UCRL-7284)
on proton (p-p) interactions near 660 Mev, 17: 28147 (JINR-P-1266)
on publications of LASL research from 1957 to 1962, 17: 26946 (LAMS-2895)
on radiation effects on elastomers, 17: 27885 (AD-282467)
on radiation uses in agriculture, 17: 27635 (NP-12928)
on radiation uses in agriculture, 17: 27636 (NP-12929)
on thermodynamic properties of molybdenum and niobium, 17: 27793 (NP-12938)
on thermoelectricity, 17: 27998
on Thorotrast and related subjects, 17: 27062(R) (TID-18722)
on tracers in chemical reaction mechanism studies, 17: 27330
radiation effects on nervous system, 17: 27194
BIOLOGICAL MATERIALS
analysis, activation, 17: 26963 (EUR-128.i)
analysis for gold, activation, 17: 27267
analysis for strontium isotopes, 17: 27165

dose distribution in, design of miniature tissue equivalent ionization chambers for determination of, 17: 27076
BIOLOGICAL SYSTEMS
radiation effects on, nature of, 17: 27131
BIOLOGY
book: *The Role of Magnesium in Biologic Processes*, 17: 27052
radioisotope uses in, review, 17: 27005
BIPHENYL
radiolysis, gas G-values from, 17: 27423(R) (TID-18195)
thermodynamic properties, 17: 28433(R) (IDO-11005)
BISMUTH
analysis for impurities, spectrographic, 17: 27309
corrosive effects on carbon steel, 17: 27755
proton reactions (p,xn), spallation, 17: 28268
separation from fused salt by packed-column extraction, rate processes in, 17: 27492 (BNL-791)
BISMUTH COMPOUNDS
ingestion effects in rabbits, electron microscopy of, 17: 27021
BISMUTH IODIDES
Bi–BiI_3, electric conductivities of molten, 17: 27318 (NAA-SR-8086)
BISMUTH ISOTOPES Bi-209
deuteron fission at 7–21 Mev, cross sections and fragment angular distributions from, 17: 28314
BISMUTH ISOTOPES Bi-210
beta sorption from, as function of atomic number, 17: 28184
BISMUTH OXIDES
incorporation into uranium dioxide lattice, 17: 27487
BISMUTH SYSTEMS
Bi–BiI_3, electric conductivities of molten, 17: 27318 (NAA-SR-8086)
BLOOD
analysis for estrogen in, of broilers fed 3,4-dianisyl-2-*t*-3-hexene, use of tritium for, 17: 27050
effects of unknown agent on erythrocyte sedimentation rate in human, effects of lead shielding on, 17: 27129
effects of unknown agent on sedimentation rate of erythrocytes in human, 17: 27128
radiation effects on, of medical personnel, 17: 27620
radiation effects on, at 50 to 500 r, 17: 27160
radiation effects on mouse, continuous, 17: 27148
BLOOD COAGULATION
radiation effects on, 17: 27202
BLOOD DISEASES
iron metabolism by erythrocytes in hemolytic, tracer study, 17: 27015
BLOOD PLATELETS
bactericidal properties, 17: 27125
radiation effects on mouse, continuous, 17: 27148
BLOOD SERUM
bactericidal properties of rabbit platelet, effects of radiation, antiserum, and Thorotrast on, 17: 27125
radiation effects on protein composition, effects of age, 17: 27171
BLOOD VESSELS
radiotherapy of hemangiomas, design of soft x-ray tube for, 17: 26991
radiotherapy of hemangioma, development of carcinoma from, 17: 27130
thorium dioxide effects on development of hemangioendothelial sarcoma in liver in man, 17: 27190
BODY FLUIDS
beryllium transport in, 17: 27045
BOILERS
design, 17: 27557(P)
design of closure for access holes in, 17: 27528(P)
BOILING
heat transfer in, in annular tubes and rectangular channels, 17: 27537 (NASA-TN-D-1656)
heat transfer in nucleate pool, simulation by gas injection at interface, 17: 27550
nucleate, peak heat flux and temperature difference in cryogenic liquid, 17: 28094
BOILING REACTORS
control by discontinuous method, 17: 28540
design for steam–water separation, 17: 28553(P)
design for water desalinization, 17: 28499
design with combined natural-forced circulation, 17: 28555(P)
development of heavy-water-moderated, for desalination plants and power production, 17: 28526(R) (DP-845)
fuel element burnout testing in, effects of rod spacing on, 17: 28423(R) (DPST-63-69-6)
role in future power plants, 17: 28543
BONDS
length measurement by electron diffraction methods, 17: 27358
BONE MARROW
gamma scanning, evaluation of radioisotopes, 17: 26964(R) (ORINS-42)
immune response to injected, in irradiated patients, 17: 26964(R) (ORINS-42)
preservation of graft material, effects on immune reaction in irradiated recipient, 17: 26971
radiation effects on, in mice, 17: 27154
radiation effects on mouse, cosmic, 17: 27198
radiation effects on lipid content, whole-body exposure, 17: 26964(R) (ORINS-42)
radiation effects on, in rats, 17: 27139
radiation effects on cellular constituents of, in rat, 17: 27147
radiation injuries, effect of treatment with cell-free spleen extract, 17: 27073
therapeutic effects in radiation injury, genetic factors in, 17: 27206
therapeutic effects in radiation injury, genetic factors in, 17: 27207
BONES
analysis for alpha-emitting elements, radiochemical, 17: 27172
analysis for radium-226 content, 17: 27051
analysis for strontium-90, samples collected in 1962, 17: 27592(R) (HASL-138)
analysis of ashes for alpha-emitting radioisotopes, radiometric, 17: 27285
analysis of human mandibular for trace elements, radiochemical, 17: 27014
analysis of human baby, for strontium-90 content, 17: 27033
calcium-45 and strontium-85 uptake by rat, effects of fluoridated water on, 17: 27044
calcium-45 uptake by, in Rhesus monkeys, 17: 27039
lead deposition in, tracer study, 17: 27016
radiation effects of internally deposited strontium-89 on, in rats, 17: 27149
strontium-90 levels in, in Italy, 1961, 17: 27591 (EUR-223.i)
BORIC ACID
effects on ion-exchange processes, 17: 27493 (WCAP-3716)
properties of solutions at high temperatures, 17: 27813 (WCAP-3713)
BORON
determination as impurity in bismuth, spectrographic, 17: 27309
determination in hafnium, titanium, and zirconium using curcumin, 17: 27265
determination in purified graphite, emission spectrographic, 17: 27286
determination in uranium tetrafluoride by solvent extraction using dichloromethane, photometric, 17: 27307
neutron absorption rates for, 17: 28244 (KAPL-M-SW-2)
production of pure microspheres of, 17: 27789(R) (MLM-1156)
use in fuel-reprocessing vessels, 17: 27502
BORON HYDRIDES
deuterium–hydrogen exchange in penta-, 17: 27410
SbH_3–$B_{10}H_{14}$, heat of explosion, 17: 27322 (UCRL-7301-T)
BORON IONS
electron affinities of, relativistic and nonrelativistic, 17: 27996
BORON ISOTOPES
separation of, by fractionation, design of cascade apparatus for, 17: 27715(T) (AEC-tr-5855)
BORON ISOTOPES B-10
alpha reactions (α,p) at 22 Mev, angular distributions from, 17: 28288
BORON STEEL
properties of, for use in reactors, alloying effects of aluminum and chromium on, 17: 28493
BOSONS
condensation in gas of, absence of Bose-Einstein, 17: 28181
representation of systems of, canonical commutation relations for, 17: 28179
BRAIN
radiation effects, 17: 27069(T) (JPRS-19284)

radiation effects on 5-hydroxytryptamine content in rat and mouse, 17: 27110
radioinduced allergic encephalomyelitis in rats, 17: 27124
BRAIN TUMORS
diagnosis of, by gamma encephalography, effectiveness of, 17: 26997
BRAZING ALLOYS
development of exothermic, for refractory alloys, 17: 27760(R) (NP-12901)
BREASTS
analysis for estrogen in, of broilers fed 3,4-dianisyl-2-*n*-3-hexene, use of tritium for, 17: 27050
radiotherapy of cancer of, effectiveness of, 17: 27006
BREEDER REACTORS
conversion factors of bare homogeneous, 17: 28421 (CNAM-5)
design concepts of liquid-metal, 17: 28458 (TID-7650(p.210-43))
fuel for fast, evaluation of fused plutonium and uranium chlorides as, 17: 27797 (PAN-414/V)
BREMSSTRAHLUNG
absorption and emission by plasma in magnetic field, 17: 28358 (ARL-63-62)
emission in electron reactions with gold foils at 25–100 kev, optical, 17: 28313
BREMSSTRAHLUNG SOURCES
design for thickness gages, 17: 27681(P)
BROMINE ISOTOPES Br-79
nuclear magnetic resonance spectra of, in electrolyte solutions, 17: 27365
BROMINE ISOTOPES Br-80
nuclear magnetic resonance spectra of, in electrolyte solutions, 17: 27365
BROOKHAVEN ALTERNATING-GRADIENT SYNCHROTRON
beams from, quadrupole-magnet double-focusing of secondary, 17: 28347 (BNL-7120)
BROOKHAVEN REACTOR
fuel-storage canal of, reconditioning of, 17: 28498
BROOKHAVEN SYNCHROTRON
equipment for, engineering drawings of auxiliary, 17: 28354
BUBBLE CHAMBERS
particle track geometrical reconstruction methods for, 17: 27686 (NIRL/R/14)
BUBBLES
formation and motion in viscous liquid flow, 17: 27543(R) (NYO-10486)
radioinduced nucleation in water, theory, 17: 28032
BUTADIENE
sodium, radiation effects on structure of, 17: 27931
butadiene–styrene, radiation effects on structure of, 17: 27931
BUTADIENE POLYMERS
radiovulcanization of, role of free radicals in, 17: 27485
BUTANE, 1-BROMO-
radioinduced reactions with tin, 17: 26944(R) (BMI-1630(Del.))
1-BUTANOL
electron emission in, point air-flow counter for exo-, 17: 27688
BUTYL PHOSPHATE COMPLEXES
with water, evidence for, 17: 27219
BUTYL PHOSPHATES
analysis for water, infrared absorption spectrographic, 17: 27239 (PG-Report-467)
kerosene–tributyl phosphate, separation from organic contaminants in ore refinery, 17: 27405 (NLCO-882)
BUTYRIC ACID, α-AMINO-
radioinduced deamination in aqueous solution, 17: 27431

C

CADMIUM
determination as impurity in bismuth, spectrographic, 17: 27309
photon reactions with, proton angular distributions and yields at >8 Mev, 17: 28265
spectra in reaction zone of acetylene air flame, excitation of atomic, 17: 27371(T)
CADMIUM CHLORIDES
effects on shielding properties of cements and concretes, 17: 27930
CADMIUM ISOTOPES Cd-109
energy levels of, nuclear moments and spin of ground-state, 17: 28312
CADMIUM ISOTOPES Cd-114
neutron reactions (n,γ), gamma spectra from, 17: 28332
CADMIUM OXIDES
incorporation into uranium dioxide lattice, 17: 27487
CADMIUM SELENIDES
hardness of single crystals of, micro-, 17: 27343
CADMIUM SULFATES
effects on shielding properties of cements and concretes, 17: 27930
CADMIUM SULFIDE CRYSTALS
energy storage device using, design of, 17: 28104(P)
hardness of, micro-, 17: 27343
CALCIUM
absorption by intestine in senile osteoporosis, tracer study, 17: 27017
determination as impurity in bismuth, spectrographic, 17: 27309
exchange reactions with magnesium, potassium, and sodium on ion exchange resin, equilibrium constant for, 17: 27038
partition coefficients and reciprocal ionic radii, 17: 27562 (INSJ-54)
proton reactions with, proton angular distributions and yields at >8 Mev, 17: 28265
proton scattering at 730 Mev, differential cross sections and polarizations for, 17: 28157 (UCRL-10637)
separation from waste solutions by combined sodium carbonate-hydroxide precipitation and foam process, 17: 28584(R) (RAI-113)
soil-plant exchange reactions, tracer study, 17: 27046
spectra in reaction zone of acetylene air flame, excitation of atomic, 17: 27371(T)
spectra of, oscillator strength of resonance line of, 17: 27370(T)
CALCIUM ALLOYS
Ca–Zn, phase studies, 17: 27800 (TID-17136)
CALCIUM BORIDES
electron structure and physical properties of crystals of, 17: 27875
CALCIUM CARBONATES
moisture content of, determination of, by beta transmission, 17: 27642
CALCIUM COMPLEXES
formation and properties of α-picoline–thiocyanate, 17: 27332
CALCIUM HYDRIDES
thermodynamic properties at 600 to 900°C, 17: 27357
CALCIUM IONS
determination in fertilizers and ion exchangers by double-decomposition radio-release technique, 17: 27233(R) (ORO-588)
CALCIUM ISOTOPES Ca-40
alpha reactions (α,p) at 22 Mev, angular distributions from, 17: 28288
CALCIUM ISOTOPES Ca-42
energy levels of, lifetimes of first and second, 17: 28333
CALCIUM ISOTOPES Ca-45
uptake by bones and teeth in Rhesus monkeys, 17: 27039
uptake of, by bones in young rats, effects of fluoridated water on, 17: 27044
CALCIUM ISOTOPES Ca-47
uptake by bone metastases from breast cancer, 17: 27019
CALCIUM OXIDES
additive effects on thermal conductivity of uranium dioxide, 17: 27814(T) (EURAEC-103)
incorporation into uranium dioxide lattice, 17: 27487
oxygen vacancy motion in thorium (IV) oxides containing, electrical and mechanical relaxation from, 17: 27869
CALIFORNIUM ISOTOPES Cf-246
alpha decay of, 17: 28318
CALIFORNIUM ISOTOPES Cf-252
fission of, ternary, 17: 28257 (UCRL-10772)
CALORIMETERS
calibration for radiation dosimetry measurements, 17: 27423(R) (TID-18195)
design and performance of x-ray, 17: 27057 (MMPP-196-2)
design of Bunsen ice, 17: 27792 (NP-12933)
design of liquid-gas, for measuring deformation energy in metals, 17: 27663
standards for solution, 17: 27323 (UCRL-7325-T)
CANDU REACTOR
development, May 1963, 17: 28533(R) (SRO-83)

CARBAMIC ACID, DIETHYLDITHIO-, SODIUM SALTS
protective effects of, against toxicity of 2,2'-dichloro-*N*-methyldiethylamine, 17: 27030
CARBIDES
bibliography on properties of transition metal refractory, 17: 27809 (UCRL-7284)
CARBOHYDRAZIDE, DIPHENYL-
use in polonium compound distillation, 17: 27349
CARBON
determination in uranium carbide by combustion and absorption of carbon dioxide, 17: 27235 (PG-Report-444)
determination of elemental, in sodium by isotope dilution mass spectrometry, 17: 27317 (NAA-SR-7918)
determination in sodium, method for, 17: 27244(T) (AEC-tr-5839)
localization of, in rat endocrine glands and reticuloendothelium, 17: 26967
meson (π^-) interactions with, at 915 Mev, Monte Carlo calculation of, 17: 28199
neutron cross sections for, fast, 17: 28245 (KFK-120)
permeability of, process for decreasing, 17: 27884(P)
preparation of kryptonated, by high-pressure diffusion, 17: 27639(R) (TID-18881)
production and properties of vitreous, 17: 27735(T) (AEC-tr-5838)
proton scattering at 730 Mev, differential cross sections and polarizations for, 17: 28157 (UCRL-10637)
radioinduced stresses in, from fission fragment bombardment, 17: 27888 (BMI-1635)
spectra in reaction zone of acetylene air flame, excitation of atomic, 17: 27371(T)
CARBON BLACK
reinforcement of rubber with irradiated, 17: 27649(P)
CARBON DIOXIDES
absorption by magnesia at 300 to 900°C, effects of calcination on, 17: 27313(R) (ASD-TDR-62-843)
analysis for residual gas after absorption by potassium hydroxide, volumetric, 17: 27238 (PG-Report-463)
effects on hydridation of zirconium, 17: 27730(R) (HW-77052)
electron diffusion in plasmas of, in magnetic fields, 17: 27650(R) (AD-297382)
production in x-irradiated tissue cells, 17: 27057 (MMPP-196-2)
radioinduced reactions with cumene, heptane, and nonane, yields in, 17: 27458
spectra of, infrared absorption bands at 4.6–5.3 μ, 17: 27361
thermodynamic and transport properties at 0 to 1500°F, 17: 27402
CARBON IONS
electron affinities of, relativistic and nonrelativistic, 17: 27996
CARBON ISOTOPES C-11
production of recoil products of, in propane, phase dependence of, 17: 27415 (BNL-6354)
CARBON ISOTOPES C-12
alpha reactions (α,p) at 22 Mev, angular distributions from, 17: 28288
energy levels, theoretical study, 17: 28264
neutron scattering at 14 Mev, differential and excitation cross sections for, 17: 28301
proton inelastic scattering by, at 155 Mev, 17: 28264
protons inelastic scattering at 182 Mev, impulse approximation calculations for, 17: 28300
reactions with nuclei at 114 Mev, total cross sections for, 17: 28256 (UCRL-10766)
reactions with oxygen-16, magnesium-24 and silicon-28 parity and spin from, 17: 28324
reactions with tellurium-128 and -130, effects of angular momentum on excitation functions of, 17: 28346
scattering by tantalum, phase shift analysis of, 17: 27949 (UCRL-10769)
triton reactions (t,α) on, distributions from, 17: 28338
CARBON ISOTOPES C-14
beta spectra of, use of scintillation counter in detecting, 17: 27453
production by cosmic neutrons, 17: 28132
use in age estimations, survey of 1963 data on, 17: 27581
CARBON MOLECULES
spectra of, absolute intensity of swan bands in, 17: 27324 (UCRL-10620)
CARBON STEEL
corrosion by molten bismuth and lithium, 17: 27755
properties of, alloying effects of uranium on forging, mechanical, and thermal, 17: 27823
CARBON SULFIDES
spectra of, infrared, 17: 27727 (ASD-TDR-63-322)
CARBON SYSTEMS
C–O–U, phase studies on, 17: 27802 (TID-18809)
C–Th–U, compatibility with niobium, tantalum, and zirconium, 17: 26944(R) (BMI-1630(Del.))
C–Th–U, compression fracture strength, 17: 26944(R) (BMI-1630(Del.))
CARBON TETRACHLORIDE
effects on development of liver metastasis after tumor cell injection, 17: 26974
spectra of, infrared, 17: 27727 (ASD-TDR-63-322)
CARBONATES
analysis for barium, iron group elements, niobium, and strontium, spectrographic, 17: 27228 (EUR-32.f)
radiation effects on photoconductivity of, 17: 27793 (TID-18843)
CARCINOGENESIS
effects of gamma and x radiation on, in animals and man, 17: 27187
CARCINOMAS
bronchial, effects of pneumonectomy and radiotherapy on, 17: 27007
diagnosis of cervical, use of phosphorus-32 for, 17: 26968
induction by combined application of whole-body x irradiation and *N*-nitrosodiethylamine, 17: 27155
of thyroid gland, detection of pulmonary metastases in, 17: 26998
of thyroid gland, use of scintillation scanning for studying metastases of, 17: 26996
radioinduced on skin after therapy for hemangioma, 17: 27130
radiotherapy of breast, effectiveness of, 17: 27006
radiotherapy of cervical, percutaneous, 17: 26976
radiotherapy of gynecologic, review on history of, 17: 27012
radiotherapy of ovarian and tonsil, evaluation of supervoltage, 17: 26973
radiotherapy of, using Mev-range x radiation, 17: 27000
radiotherapy of uterine, delayed radiation proctitis from, 17: 27183
CAROLINAS-VIRGINIA TUBE REACTOR
development and operation, May 1963, 17: 28533(R) (SRO-83)
development, Jan.–Mar. 1963, 17: 28523(R) (CVNA-181)
CASCADES
design of, for separation of boron isotopes, 17: 27715(T) (AEC-tr-5855)
key weight, for multicomponent isotope separation, 17: 27712 (K-1571)
CAST IRON
stresses in, feasibility of infrared detection of, 17: 27508 (SCTM-59-63(25))
CATALYSIS
radiation effects on, 17: 27419 (JAERI-4024)
CATALYSTS
performance of metal-promoted aluminas and silicas in hydrocracking polyphenyls, 17: 28434 (IDO-16858)
properties of, for use in enrichment of heavy water by isotope exchange, 17: 27388
radiation effects on solid, 17: 27419 (JAERI-4024)
use of metal-oxide support, for deuterium exchange at high temperatures and pressures, 17: 27719(P)
CATARACTS
radiation effects on incidence of, 17: 27186
CATHODES
materials for thermionic-cell, 17: 27960
properties of boride, in thermionic cells, 17: 27966
CATION EXCHANGE MATERIALS
equilibrium constants for binary alkali metal cation systems on zeolites, 17: 28581(R) (HW-77299)
CAVES
design of, for ANP decontamination, engineering drawings for, 17: 27520
design of, for Thorium Fuel Cycle Development Facility, 17: 28462 (TID-7650(p.333-50))
design of iron-shielded, for whole-body radioactivity counting, engineering drawings for, 17: 27516
liners for, in Multicurie Fission Product Pilot Plant, engineering drawings for, 17: 27518

material transfer in high-level, engineering drawings of equipment for, 17: 27519
radiation monitoring in, design of high- and low-level instruments for, 17: 27684 (HW-67376)
CAVITY RESONATORS
resonant modes of coaxial, TE_{omn}, 17: 28373
CELLULOSE
radiation effects on, in plants, 17: 27088
radiation effects on, electron spin resonance investigations of gamma, 17: 27454
radioinduced crosslinking of regenerated film, for improved mechanical properties, 17: 27935(P)
radiolysis, 17: 27426
CELLULOSE ACETATES
radiation effects on photoconductivity of, 17: 27893 (TID-18843)
CELLULOSES
radioinduced polymerization of hydroxyethyl-, methyl-, and methylhydroxybutyl-, 17: 27088
CEMENTS
shielding properties of, effects of barium and cadmium salts on, 17: 27930
CERAMIC MATERIALS
dielectric constant and loss tangent at 100 to 1200 Mc and 500 to 2300°F, 17: 27798 (RADC-TDR-62-307)
performance under simulated space conditions, 17: 27506 (NP-12906)
sinterability, evaluation of properties affecting, 17: 27313(R) (ASD-TDR-62-843)
CERIUM
determination using antipyrine and its derivatives, photometric, 17: 27304
effects of, on impurities, mechanical properties, and oxidation of Cr–Mo–U steel, 17: 27859
partition coefficients and reciprocal ionic radii, 17: 27562 (INSJ-54)
CERIUM ACETYLACETONATES
structure, 17: 27329
CERIUM ALLOYS
Ce–Co–Pu, analysis by solvent extraction, 17: 27789(R) (MLM-1156)
Ce–Co–Pu, corrosive effects on tantalum, 17: 28565(R) (LAMS-2915)
Ce–Co–Pu, viscosities of, 17: 27789(R) (MLM-1156)
Ce–Cu–Pu, properties of, 17: 27789(R) (MLM-1156)
Ce–Ni–Pu, properties of, 17: 27789(R) (MLM-1156)
CERIUM BORIDES
electron structure and physical properties of crystals of, 17: 27875
CERIUM FLUORIDES
CeF_3–CeO_2, refractive indices of mixtures of, 17: 27355
CERIUM OXIDES
additive effects on pulse height of quartz phosphors, 17: 27701
additive effects on thermal conductivity of uranium dioxide, 17: 27814(T) (EURAEC-103)
entropy and heat content at 298 to 1800°K, 17: 27314 (BM-RI-6248)
spectra of, infrared absorption, 17: 27840
BeO–CeO_2, phase studies, 17: 27833
CeF_3–CeO_2, refractive indices of mixtures of, 17: 27355
CESIUM
corrosive effects on thermionic cell materials, 17: 27965
electron reactions with atoms in plasma of, cross sections for, 17: 27955
field emission effects on rhenium and tungsten, 17: 27971
ion exchange on resins, effects of boric acid and potassium hydroxide on, 17: 27493 (WCAP-3716)
ionization near thermionic diode collectors coated with, 17: 27974
ionization of, graphical method for optimization of surface, 17: 27989
ionization transients in, 17: 28043
metabolism in rat fetuses, tracer study, 17: 27036
oscillations in synthetic plasma beams of, 17: 28394
partition coefficients and reciprocal ionic radii, 17: 27562 (INSJ-54)
properties of plasma of, thermodynamic and transport, 17: 27956
reactions of vaporous, with molybdenum, 17: 27967
separation from alkali metal chlorides and chloroplatinates, method for, 17: 27243(T) (AEC-tr-5822)
separation from Purex wastes by inorganic ion exchangers, 17: 28581(R) (HW-77299)
separation from wastes by solvent extraction using dipicrylamine, 17: 28580 (HW-76222)
separation from waste solutions by combined iron-phosphate coagulation and foam process, 17: 28584(R) (RAI-113)
sorption on refractory metals, 17: 27970
thermal conductivity of vaporized, 17: 27957
thermal conductivity of vaporized, at thermionic temperatures, 17: 27958
thermal conductivity of vaporized, in thermionic diode, 17: 27959
thermionic emission by zirconium carbide in vaporized, 17: 27977
wave propagation in tubular plasma of, 17: 28390
work function reduction by, in thermionic cells, 17: 27972
CESIUM ALLOYS
Cs–Au, electric conductivity, Hall constant, and Seebeck coefficient of semiconducting, 17: 27872
CESIUM AZIDES
radiation effects on photoelectric properties of, 17: 27468
CESIUM BROMIDE CRYSTALS
spectra of, F-center positions in, 17: 27377
CESIUM CHLORIDE CRYSTALS
spectra of, F-center positions in, 17: 27377
CESIUM FLUORIDES
Cs–CsF–Mo, properties as thermionic emitter, 17: 27973
Cs–CsF–W, properties as thermionic emitter, 17: 27973
CESIUM IODIDE CRYSTALS
scintillation process in thallium-activated, comparison with activator saturation model for ionizing-radiation excited, 17: 27463
scintillation process in thallium-activated, emission spectra and self-trapped holes in ionizing-radiation excited, 17: 27464
spectra of, F-center positions in, 17: 27377
CESIUM IONS
production of, graphical method for optimization of, 17: 27989
CESIUM ISOTOPES Cs^{133}
energy levels of, spin assignments and transition polarities from barium-133 decay, 17: 28267
CESIUM ISOTOPES Cs^{137}
absorption by soil, 17: 27602(T) (EURAEC-416)
absorption of, by barley in competition with other cations, 17: 27031
content in children, 17: 27013 (TID-18878)
content in food, lake waters, plants, and soil in Italy, 1961, 17: 27591 (EUR-223.i)
content in people and diet in Finland, 17: 27023
content in vegetation in Northern Alaska from fallout, 17: 27053 (HW-SA-3050)
determination in food, 17: 27277
separation from solutions by ion exchange on calcined montmorillonite, 17: 27218
separation from waste by Dowex-50W and clinoptilolite, 17: 28581(R) (HW-77299)
CESIUM SYSTEMS
Cs–CsF–Mo, properties as thermionic emitter, 17: 27973
Cs–CsF–W, properties as thermionic emitter, 17: 27973
Cs–He, cesium ionization transients from electric discharges in 17: 28043
CHALK RIVER PLANT
monitoring of environs for radioactivity, 1962, 17: 27585 (AECL-1765)
CHARCOAL
absorption of iodine-131 on activated, in chemical processing plant effluent, 17: 27417 (HW-77126)
CHARGED PARTICLE BEAMS
current monitoring in pulsed, design of pre-amplifiers and toroidal transformers for, 17: 27687 (NIRL/R/30)
focusing of, ideal polar surfaces for weak or strong, 17: 28350
focusing of, quadrupole-magnet double-, 17: 28347 (BNL-7120)
measurement and viewing, apparatus for, 17: 28356(P)
CHARGED PARTICLES
book: *Passage of Charged Particles Through Matter*, 17: 28071
charge space, analysis, 17: 28174
Cherenkov emission by, in optically isotropic medium, 17: 28186(T)
containment by orthogonal standing waves, three-dimensional, 17: 28396
detection and measurement, by selective dissolution of tracts in high polymers, 17: 27925
diffusion-mobility relation of, diffusion forces from Einstein's, 17: 28030
interactions with electrons in plasma, theory of, 17: 28384

motion in electric and magnetic fields, approximations for, 17: 28017
radiation emission of accelerated, in static homogeneous gravitational fields, 17: 27990
temperature of ionospheric, altitude dependence of, 17: 28060
CHELATES
toxic effects on rats, 17: 27026
use for acceleration of urinary excretion of radioisotopes, 17: 27024
CHEMICAL ANALYSIS
developments at Idaho Chemical Processing Plant, summary, 17: 27231(R) (IDO-14605)
method for alkali metals in minerals and ores, 17: 27243(T) (AEC-tr-5822)
CHEMICAL PROPHYLAXIS
methods in, 17: 27161
CHEMICALS AND REAGENTS
preparation and properties for determination of thorium in rocks, 17: 27246
CHEMOTHERAPY
of neoplasms by combination with radiotherapy, 17: 26990
CHERENKOV RADIATION
emission by optically isotropic medium, theory of, 17: 28186(T)
CHICKENS
analysis for tritium in tissues of broilers fed 3,4-dianisyl-2-t-3-hexene, use of tritium for, 17: 27050
radiation effects on erythrocytes in male, 17: 27166
CHIMERAS
plant, genetic structure demonstrated after x irradiation, 17: 27100
CHLORIDES
corrosive effects on chromium–iron–nickel alloys at 500 and 550°F, 17: 27749 (KAPL-M-CC-3)
heats of dissociation of gaseous, 17: 27315 (LA-2841)
CHLORINE
bond length measurement by electron diffraction, 17: 27358
recombination rates in shock tubes, direct measurement of atomic, 17: 27373
use in chemical regeneration of sublimating metallic surfaces in thermionic cells, 17: 27968
CHLORINE ISOTOPES Cl-36
neutron total cross sections at 3–5 Mev, fast, 17: 28287
CHLORINE ISOTOPES Cl-38
neutron total cross sections at 3–5 Mev, fast, 17: 28287
CHLOROFORM
energy level density of, vibrational, 17: 27367
chloroform-2,4-pentanedione, solvent properties for scandium, 17: 27369
chloroform-1,3-diphenyl,1-3-propanedione, solvent properties for scandium, 17: 27369
CHROMATOGRAPHY
paper chromatograms, liquid scintillation counting of radioactive, 17: 27275
review of instrumentation for gas-liquid, 17: 27272
CHROME AZUROL S
chelate with thorium(IV), composition and stability of, 17: 27214
CHROMIUM
alloying effects on properties of boron steel, 17: 28493
catalytic effects on hydrocracking of polyphenyls, 17: 28434 (IDO-16858)
deformation, thermally activated, 17: 27879
determination as impurity in bismuth, spectrographic, 17: 27309
determination in polyphenyls, x-ray spectrographic, 17: 27227 (EUR-28.f)
determination in SAP, x-ray spectrographic, 17: 27226 (EUR-21.f)
determination in stainless steel microspheres, activation, 17: 27253
distribution in Zircaloy-2 and zirconium oxide, use of electron microprobe for determination of, 17: 27746(R) (DPST-63-71-1)
neutron cross sections for, fast, 17: 28245 (KFK-120)
separation from thorium using liquid-metal extraction, 17: 28465 (TID-7650(p.436-53))
solubility in alpha–zirconium at 360 and 400°C, 17: 27728(R) (GEAP-4076)
spectra in reaction zone of acetylene air flame, excitation of atomic, 17: 27371(T)
CHROMIUM ALLOYS
Cr–Fe, ferromagnetism and atomic magnetic moments of, effects of solute concentration on, 17: 27801 (TID-17141)
Cr–Fe–Mo–Ni, stress-corrosion cracking by boiler water at 500°F and sea water at 550°F, 17: 27749 (KAPL-M-CC-3)
Cr–Fe–Ni, stress-corrosion cracking by boiler water at 500°F and sea water at 550°F, 17: 27749 (KAPL-M-CC-3)
Cr–Nb, phase diagram, 17: 27825
Cr–Nb–Ti, phase studies, 17: 27826
Cr–Ni–Nb, phase diagram, 17: 27825
Cr–Sn–Zr, analysis of corrosion films on, for zirconium-to-chromium and -to-tin ratios, 17: 27728(R) (GEAP-4076)
CHROMIUM CARBIDES
bibliography on properties, 17: 27809 (UCRL-7284)
CHROMIUM COMPACTS
density, 17: 27829
CHROMIUM ISOTOPES Cr-51
preparation by Szilard-Chalmers reaction, 17: 27420 (KR-40)
radiation effects on content in liver nucleic acids and proteins after injection of sodium radiochromate, 17: 27084
CHROMIUM ISOTOPES Cr-53
neutron reactions (n,α) with, chromium-54 energy levels and spins from thermal, 17: 28320
CHROMIUM ISOTOPES Cr-54
energy levels of, spins for, 17: 28320
CHROMIUM NITRIDES
electron structure and physical properties of crystals of, 17: 27875
sintering of, electron density in phase lattices and optimal conditions for, 17: 27767
CHROMIUM OXIDES
catalytic effects on hydrocracking of polyphenyls, 17: 28434 (IDO-16858)
Cr_2O_3–ZrO_2, characterization of hot-pressed, 17: 27728(R) (GEAP-4076)
CHROMIUM SILICIDES
electron structure and physical properties of crystals of, 17: 27875
CHROMIUM STEEL
Cr–Mo–U, effects of cerium on impurities, mechanical properties, and oxidation of, 17: 27859
Cr–Ni, corrosion by sodium at 1000°C, 17: 27756
CHROMOSOMES
aberrations in regenerating liver, effects of age and radiation exposure, 17: 27176
effect of size, on radiosensitivity of plants, 17: 27153
radiation effects on Drosophila, cosmic, 17: 27200
radiation effects on, in root tips of *Avena sterilis*, 17: 27087
radiation injury, effects on cell survival, 17: 27152
ultraviolet radiation effects in different phases of mitosis, 17: 27168
CIRCUITS
data retrieval system for modules of pulse, descriptors for two-phase automatic, 17: 27724 (TID-18886)
design, for digital integrating dose meter for use in x ray therapy, 17: 27164
CIVIL ENGINEERING
uses of atomic and chemical explosions in excavations, 17: 27504 (EUR-7.f)
CIVILIAN DEFENSE
aerial surveying of high-intensity gamma radiation in small area, evaluation, 17: 26945 (CEX-62.6.2)
psychologic discomfort survey on shelters, 17: 27611
restoration of metropolitan water works following nuclear attack, 17: 27595 (NP-12902)
survival ration evaluation, 17: 27612
CLAYS
radioactivity of, in oil well sections in Crimea and Eastern Caucasus Foreland, 17: 27572
CLOUDS
infrared reflection by, 17: 27563 (NP-12932)
COAL
analysis for ash content of, beta radiation method for, 17: 27283
analysis of, nuclear techniques for, 17: 27240(R) (TID-18883)
COBALT
diffusion in cobalt and cobalt–nickel alloys, magnetic effect on, 17: 27841
ion exchange on resins, effects of boric acid and potassium hydroxide

on, 17: 27493 (WCAP-3716)
photon reactions with, proton angular distributions and yields at >8 Mev, 17: 28265
separation from nickel, methods for, 17: 27401
spectra in reaction zone of acetylene air flame, excitation of atomic, 17: 27371(T)
stress relaxation and dynamic recovery in, at 77–384°K, 17: 27867

COBALT ALLOYS
Co–Co–Pu, analysis by solvent extraction, 17: 27789(R) (MLM-1156)
Co–Co–Pu, corrosive effects on tantalum, 17: 28565(R) (LAMS-2915)
Co–Co–Pu, viscosities of, 17: 27789(R) (MLM-1156)
Co–Mo, structure of sigma phase Co_xMo_y, 17: 27818
Co–Mo–Pt, catalytic effects on hydrocracking of polyphenyls, 17: 28434 (IDO-16858)
Co–Nb, phase studies, 17: 28565(R) (LAMS-2915)
Co–Ni, diffusion in, magnetic effect on, 17: 27841
Co–Ta, phase studies, 17: 28565(R) (LAMS-2915)

COBALT ISOTOPES
deuteron reactions (d,n) on, distributions from, 17: 28335

COBALT ISOTOPES Co-57
decay of, L/K ratio for electron capture, 17: 28325

COBALT ISOTOPES Co-58
decay of, L/K ratio for electron capture, 17: 28325

COBALT ISOTOPES Co-59
alpha reactions (α,p) at 22 Mev, angular distributions from, 17: 28288
neutron reactions (n,p), cross sections for, 17: 28292

COBALT ISOTOPES Co-60
radioactivity of, methods for determining, 17: 27462

COBALT MOLYBDATES
catalytic effects on hydrocracking of polyphenyls, 17: 28434 (IDO-16858)
Al_2O_3–$CoMoO_4$, catalytic effects on hydrocracking of high boilers in reactor coolant, 17: 28435 (IDO-16877)

COBALT OXIDES
catalytic effects on hydrocracking of polyphenyls, 17: 28434 (IDO-16858)
CoO–V_2O_5, catalytic effects on hydrocracking of polyphenyls, 17: 28434 (IDO-16858)

COBALT PHOSPHIDES
electron structure and physical properties of crystals of, 17: 27875

COBALT SILICIDES
electron structure and physical properties of crystals of, 17: 27875

COKE
formation during heating of organic reactor coolants, 17: 27423(R) (TID-18195)
purification of raw, for production of high-purity artificial graphite, 17: 27741

COMPUTER PROGRAMS
ALGOL, for reduction of liquid scintillation counting data, 17: 27274
ANNEX-1, for analyzing monidirectional-neutron-beam scattering from cylindrical volumes, 17: 28223 (NAA-SR-Memo-8427)
CADAVER, for preparing multigroup data, 17: 28437 (KAPL-2000-20)
DIFF, for calculating neutron diffusion constants, 17: 28220 (EUR-106.f)
ERIC I, for calculating neutron resonance integrals, 17: 28238 (AEEW-M-304)
FLOCK, for obtaining fitted rod absorption and self-shielding coefficients, 17: 28440 (KAPL-M-RPC-8)
for analyzing nuclear reaction data, FORTRAN for IBM-704, 17: 28239 (ANL-6718)
for describing gamma scattering in laminar media, 17: 28196
for electron energies in diatomic molecules, 17: 27360
for indexing x-ray diffraction powder patterns by cubic system on IBM 7090, 17: 27720 (HW-SA-2756)
for making linear, log-log or semilog plots, FORTRAN for CDC-1604, 17: 27723 (ORNL-3447)
for reactor xenon stability calculations, 17: 28416 (AE-108)
FORTRAN, for nucleon scattering from nonlocal optical potentials, 17: 28155 (ORNL-3429)
KARE input, revision V, 17: 27721 (KAPL-M-JA-6)
LASL, for automatic lens-designing, 17: 27940 (LA-2877)
modifications of FORTRAN for large, 17: 27725 (WAPD-T-1591)
MONSTER, inclusion of energy splitting, photoneutron production, and variance computation in, 17: 28246 (NDA-Memo-2123-1)
MOST, for comparing experimental and quantum mechanical cross sections, 17: 28437 (KAPL-2000-20)
MO236, for calculating minimum requirements for pressure piping systems, 17: 27511 (WAPD-R(WB)-2)
PDQ-5, for two-dimensional few-group time-independent neutron-diffusion, 17: 28228 (WAPD-T-1589)
PIXSE, for evaluating energy transfer cross sections for thermal reactor calculations, 17: 28417 (AEEW-M-318)
SHAPE, for defining contours based on geometrical shapes, FORTRAN for IBM-1620, 17: 27509 (TID-18844)
SOAP-II, for calculation of dielectric properties and loss tangent of ceramic materials on IBM-650, 17: 27798 (RADC-TDR-62-307)
SWAK, for calculating thermal cross sections and spectra, 17: 28243 (KAPL-M-RPC-6)
TRAM, for calculating low-energy neutron distributions in reactors, 17: 28222 (KAPL-M-RPC-1(Rev.1))
1559/RE, for computing neutron resonance integrals in isotopic mixtures, FORTRAN for IBM-704, 17: 28219 (ANL-6709)

CONCRETES
shielding properties of, effects of barium and cadmium salts on, 17: 27930

CONFERENCES
Background Radiation. Infrared, Ultraviolet and Visible Distributions and Levels, Chicago, April 1963, 17: 27563 (NP-12932)
Congress of the National Laboratories in Frascati, Rome, May, 1963, 17: 28138 (ISS-63/28)
Cryogenic Engineering Conference, Univ. of California, August 1962, 17: 28072
Methods of Separation of Similar Rare Metals, Moscow, November 1960, 17: 27401
Minutes of Ceramic Fuels Meeting, Brussels, Oct. 3 to 5, 1962, 17: 27734 (TID-7666)
Symposium on Thermionic Power Conversion, Colorado Springs, 1962, 17: 27954
Thorium Fuel Cycle Symposium, Gatlinburg, Tenn., Dec. 5 to 7, 1962, 17: 28447 (TID-7650)

CONSTANTS AND CONVERSION FACTORS
for flux-to-dose rate conversion in gamma dosimetry, 17: 27593 (JPL-TR-32-439)

CONTAMINATION
of radiobiology laboratories, 17: 27614
standards for water, 17: 27613

COPPER
absorption, 17: 28139 (ISS-63/28(p.1-11))
corrosion by cesium vapor, 17: 27965
deformation energy, 17: 27663
determination as impurity in bismuth, spectrographic, 17: 27309
determination in ore, activation, 17: 27281
determination in SAP, x-ray spectrographic, 17: 27226 (EUR-21.f)
determination of traces in germanium dioxide, activation, 17: 27297
distribution in zirconium oxide, use of electron microprobe for determination of, 17: 27746(R) (DPST-63-71-1)
gamma reactions at 1–2 Mev, electron pair cross section Z-dependence from, 17: 28275
photon reactions (γ,d) and (γ,p) at 24 Mev, yield ratios for, 17: 28289
photon reactions with, proton angular distributions and yields at >8 Mev, 17: 28265
preparation of kryptonated, by high-pressure diffusion, 17: 27639(R) (TID-18881)
radiation effects on internal function of, electron, 17: 27921
separation from cadmium and cobalt by precipitation using N-benzoyl-phenylhydroxylamine, 17: 27299
spectra in reaction zone of acetylene air flame, excitation of atomic, 17: 27371(T)
stresses in, feasibility of infrared detection of, 17: 27508 (SCTM-59-63(25))
use as tracer for activation analysis of cotton, 17: 27634(R) (NCSC-2477-4)
wetting behavior of liquid, on solid beryllium, effects of atmosphere and temperature on, 17: 27795 (ORNL-3438)

x-ray spectra of, selective detection of K-α radiation in, 17: 27708
x-ray spectra of, using promethium-147 beta source, 17: 27280

COPPER ALLOYS
Al–Cu, atomic number effects correction in electron probe microanalysis of, 17: 27268
Ce–Cu–Pu, properties of, 17: 27789(R) (MLM-1156)
Cu–Au, atomic number effects correction in electron probe microanalysis of, 17: 27268
Cu–Au, corrosion by cesium vapor, 17: 27965
Cu–Au, radiation disordering mechanism for, 17: 27892 (NAA-SR-Memo-504)
Cu–Nb–Zr, hydrogenation of, delayed failure from, 17: 28533(R) (SRO-83)
Cu–Sn, x-ray spectra for content ratio in, 17: 27280
Cu–U, effects of aging and warm working on hardness of, 17: 27733(R) (NMI-2116)
Cu–Zn, x-ray spectra for content ratio in, 17: 27280
Cu–Zr, hydrogen overvoltage measurements in, 17: 27728(R) (GEAP-4076)

COPPER CHLORIDES
CuCl–KCl, properties of fused, as simulated reactor fuels, 17: 27797 (PAN-414/V)

COPPER CRYSTALS
internal friction in, effects of dislocation-point interactions on Bordoni, 17: 27805(R) (TID-18859)
radiation effects on, recovery from hardening by neutron, 17: 27913
strain aging after plastic deformation at 77 to 373°K, 17: 27805(R) (TID-18859)

COPPER FOILS
argon reactions at 100 ev, dislocation dipoles and loops from, 17: 27920

COPPER ISOTOPES
deuteron reactions (d,n) on, distributions from, 17: 28335

COPPER ISOTOPES Cu-63
neutron reactions (n,γ) with, properties as resonance neutron detector, 17: 28237 (AE-102)

COPPER ISOTOPES Cu-65
proton reactions (p,pn) with, product distributions and energies in, 17: 28247(R) (TID-18788)

COPPER MINERALS
analysis for copper, activation, 17: 27281

COPPER OXIDES
$CuO–ZrO_2$, characterization of hot-pressed, 17: 27728(R) (GEAP-4076)

COPPER SULFATES
radiation effects on paramagnetic resonance in, gamma, 17: 27439

CORROSION LOOPS
design, 17: 27756
design for materials testing in aqueous slurries and solutions at high temperatures, 17: 27507 (ORNL-3449)

COSMIC ELECTRONS
energy dissipation in atmosphere by vertically incident, 17: 28117 (AWRE-E-12/63)
injection mechanisms and lifetimes of geomagnetically trapped, 17: 28131

COSMIC MESONS (μ)
angular distributions under thick layers of soil, 17: 28133
intensity variation of, temperature effects on daily, 17: 28120

COSMIC NEUTRONS
flux near earth, 17: 28118 (HW-SA-2870)
intensity variation of, temperature effects on daily, 17: 28120
reactions with nuclei, carbon-14 production from, 17: 28132

COSMIC PARTICLES
auroral chorus activity correlation with high-energy, 17: 28122
density distribution in space near earth, 17: 28126
trapping in geomagnetic fields, auroral and geomagnetic storm production from, 17: 28125

COSMIC PHOTONS
shower production by high-energy, 17: 28119 (PAN-382/VI)

COSMIC PROTONS
exposure to astronauts, recommended allowable, 17: 27605
injection mechanisms and lifetimes of geomagnetically trapped, 17: 28131

COSMIC RADIATION
bibliography, 17: 27937 (AID-62-155)
biological effects in space flights, 17: 27196
biological effects in space flight, 17: 27197
book: *Progress in Elementary Particle and Cosmic Ray Physics*, Vol. VI, 17: 28128
effects on biological indexes in Drosophila, 17: 27200
effects on diploid and haploid yeasts, effects of oleic acid on, 17: 27199
effects on hematopoietic organs in mice, 17: 27198
effects on higher plants, 17: 27201
reactions in geosphere, isotope production by, 17: 28129
shielding against, minimum structural mass for magnetic, 17: 28410
variations of low-rigidity, during sunspot cycle, 17: 28130

COSMIC SHOWERS
existence of low-photonic-energy, 17: 28119 (PAN-382/VI)

COSMOLOGY
universe expansion in, retarded potentials in, 17: 28053

COTTON
grafting to acrylonitrile, post-irradiation, 17: 27634(R) (NCSC-2477-4)
ignition by nuclear explosions, effects of burst heights and atmospheric conditions on, 17: 27945 (NP-12936)
radiation effects on properties of, gamma, 17: 27634(R) (NCSC-2477-4)
radioinduced graft polymerization to acrylonitrile, effects of oxygen on, 17: 27634(R) (NCSC-2477-4)

COULOMETERS
design of high-sensitivity scanning, for plutonium determinations, 17: 27248
development for iron analysis, 17: 27789(R) (MLM-1156)

COUNTERCURRENT SEPARATION PROCESSES
efficiency of pulsed columns in liquid-liquid, effects of phase transfer discontinuity on, 17: 27498

COUNTING DEVICES
design and performance of electronic cell, 17: 27057 (MMPP-196-2)
design for registering high-frequency electrical pulses, 17: 27677(P)

CREEP
of two-phase dispersion-strengthened crystalline materials, theory of, 17: 27882

CRISTOBALITES
grain growth of, in firing of slip-cast fused silica, 17: 27807(R) (TID-18891)

CRITICAL ASSEMBLIES
conversion factors of bare homogeneous, 17: 28421 (CNAM-5)
conversion ratios of slightly enriched-uranium water-moderated lattices, 17: 28135
criticality studies of water-reflected undermoderated zirconium hydride, 17: 28481 (TID-18880)
design and operation of ECO, for study of ORGEL, 17: 28427 (EUR-130.f)
development of Core Test Facility, quarterly summary, 17: 28565(R) (LAMS-2915)
neutron diffusion in cylindrical flux trap assembly, 17: 28031
operation of epithermal, 17: 28453 (TID-7650(p.88-127))
power distribution in, data reduction methods and experimental techniques for determination of, 17: 28439 (KAPL-M-JNB-1)
shielding design and evaluation for ORGEL critical experiment, 17: 28428 (EUR-149.f)

CRITICALITY STUDIES
bucklings of heavy water lattices of natural uranium dioxide rod clusters, 17: 28134
of water-moderated thorium dioxide-uranium dioxide fuels, 17: 28452 (TID-7650(p.76-87))
on thorium fuels, 17: 28451 (TID-7650(p.57-75))

CRYOGENICS
boiling in, peak heat flux and temperature difference in nucleate, 17: 28094
book: *Advances in Cryogenic Engineering*, Vol. 8, 17: 28072
fluid handling hazards in, 17: 28081
methods in, for temperatures below 1°K, 17: 28073

CRYOSTATS
description of helium-3, 17: 28073
design for electron irradiation of metals and semiconductors at 4.2°K, 17: 28091
design for pressure studies at liquid helium temperatures, 17: 27666

design of helium-3, for oriented nuclei experiments, 17: 28092

CRYSTAL STRUCTURE
analysis of, computer programs for indexing x-ray diffraction powder patterns for, 17: 27720 (HW-SA-2756)
analysis of, method of indexing powder diffraction patterns for, 17: 27786 (LADC-5522)
dislocation behavior in strained f.c.c. metals, experimental verification of theories of, 17: 27842
dislocation-point defect interactions in, 17: 27805(R) (TID-18859)
dislocation theory, 17: 27810 (UCRL-10788)
isotope defects in, vibrational frequencies in lattice perturbed by, 17: 28007

CRYSTALS
electron energy spectrum in Th_3P_4-type, structural analysis of, 17: 27391(T)
fission recoil tracks in, 17: 26944(R) (BMI-1630(Del.))
Mössbauer effect in simple cubic, localized mode vibrational spectrum from, 17: 27375
neutron scattering by, method for calculating, 17: 28226 (UCRL-7267)
pole figures for orthorhombic, method for inversion of, 17: 27791 (NLCO-862(Rev.4))

CUMENE
radioinduced reactions of, with carbon dioxide, yields in, 17: 27458

CURCUMIN
analytical use for determination of boron, 17: 27265

CURIUM ISOTOPES Cm-244
alpha reactions at 6.7 Mev, californium-246 alpha decay from, 17: 28318

CURRENT INTEGRATORS
design for small currents, 17: 27664

CUTTING TOOLS
design for removing cartridges from fuel elements, 17: 27525(P)
design of remotely controlled, for use in hot cells, engineering drawings for, 17: 27521

CYANOGEN
radioinduced reactions with hydrocarbons, 17: 27437

CYCLOALKANES
polymerization, 17: 27423(R) (TID-18195)

CYCLOHEXANE
radiation effects on dehydrogenation of, by nickel catalyst, 17: 27483
radioinduced reactions with cyanogen, 17: 27437
radiolysis of liquid, spur reactions in, 17: 27455

CYCLOPENTENE
octachloro-, effects of radioinduced chlorination of chlorinated pentane on yield, 17: 27480

CYCLOTRONS
electron bunching characteristics of microtrons, 17: 28352

CYLINDERS
heat transfer to water by rotating, convective, 17: 27533 (AE-107)
ionization distribution in, from electron irradiation, 17: 28009

CYSTINE
radioinduced thermoluminescence in, 17: 27427

CYTOLOGY
analyses of irradiated vaginal epithelium, 17: 27097
radiation damage in cells, role of DNA in, 17: 27107
radiation effects on metabolic processes and mitosis in cells, 17: 27108
radiosensitivity of rapidly dividing cells, 17: 27138

D

DATA RECORDING SYSTEMS
testing of automatic, 17: 28524 (DLCS-4000201(Rev.))

DATA TABULATIONS
angular distributions for fast neutron reactions with nuclei, 17: 28240 (BNL-400(Vols.I and II))
energy dissipation by electrons vertically incident on earth's atmosphere, 17: 28117 (AWRE-E-12/63)
neutron cross sections and fission data for fast reactor materials, 17: 28245 (KFK-120)
neutron diffusion coefficients for shielding materials, 17: 28220 (EUR-106.f)
radiation depth dose tables and isodose charts for medium energy x rays, 17: 27633
solar flare effects on geomagnetic fields for 1962, 17: 28113
thermodynamic properties of gaseous chlorides, 17: 27315 (LA-2841)

DECANE
polarization of irradiated, high voltage relaxation, 17: 27469

DECONTAMINATION
equipment and techniques for, review of, 17: 27624
methods of, for fuel-storage canals, 17: 28498

DENSITOMETERS
design of radiometric, for atmosphere, 17: 27656 (NYO-9854)
physical parameters of gamma absorption, 17: 27707

DENSITY
measurement of silage, by gamma ray attenuation, 17: 27645

DETERGENTS
residues of, on washed foods, tracer studies of, 17: 27637 (SAN-1020)

DETONATION WAVES
propagation in gases in the presence of electromagnetic fields, deflagration and ionization in, 17: 28014

DEUTERIUM
deuteron reactions (d,n) at 25 to 500 kev, anisotropy factors for determining total neutron yield from, 17: 28254 (UCRL-10752(Suppl.))
deuteron reactions (d,n), neutron distributions from, 17: 28329
electric discharge in, production of short-time pulses of fast neutrons in, 17: 28329
exchange between hydrogen and water vapor at high temperatures and pressures, catalyst for, 17: 27719(P)
exchange between hydrogen ions and water, equilibrium constant, 17: 27380
exchange between hydrogen gas and ammonia, method for, 17: 27718(P)
exchange with hydrogen in pentaborane catalyzed by 2,6-dimethylpyridine, 17: 27410
hydromagnetic wave propagation near ion cyclotron resonance in plasma of, 17: 28391
intensity of ultraviolet sources of, 17: 28033(T)
isotope effects in intramolecular insertion, 17: 27411
isotope exchange with ammonia, effects of nickel on, 17: 27386
isotope exchange with benzene and toluene, 17: 27389
isotopic effects on ammonia synthesis in presence of iron catalyst, 17: 27385
meson (K^-) reactions with, cross sections for charge-exchange, disintegration, and elastic, 17: 28263
separation from other hydrogen isotopes by electrolytic evolution from platinum cathode, effects of overvoltage on, 17: 27717

DEUTERIUM IONS
excited-state populations of neutral beams produced from, 17: 27950 (UCRL-10802)

DEUTERONS
emission in photon reactions (γ,d) with antimony, copper, nickel, and tin at 24 Mev, yields for, 17: 28289
interactions with charged mesons (π) at 300 Mev, cross section for elastic, 17: 28185
interactions with neutrons, doublet scattering lengths for, 17: 28210
reactions (d,α), (d,2α), (d,αn), (d,αp), (d,2np), and (d,2pn) with nickel-58 and 60 at 0–24 Mev, excitation functions and inverse cross sections for, 17: 28317
reactions (d,n) on cobalt, copper, iron, and nickel, distributions from, 17: 28335
reactions (d,n) with deuterium and tritium at 25 to 500 kev, total neutron yield from, 17: 28254 (UCRL-10752(Suppl.))
reactions (d,n) with nitrogen-14 at 5 Mev, hyperfine structure, nuclear magnetic dipole moment, and spin from, 17: 28311
reactions (d,n) with deuterium, neutron distributions from, 17: 28329
reactions (d,p) and (d,t) with palladium isotopes at 15 Mev, nuclear structure from, 17: 28315
reactions (d,p) on lithium-7, polarizations from, 17: 28336
reactions (d,p) with titanium isotopes at 21.4 Mev, energy level transition cross sections from, 17: 28323
reactions on thorium and uranium, fission cross sections in, 17: 28337
reactions with nuclei $204 \leq A \leq 239$ at 7–21 Mev, fission cross sections and angular distributions from, 17: 28314
scattering by vanadium-51 at 8 to 10.5 Mev, differential cross sections for elastic, 17: 28306
yields in oxygen-16 reactions at 167 Mev, 17: 28252 (UCRL-10693)

DIAMONDS
radiation effects on type IIa, electron spin resonance in neutron, 17: 27918
DIDO REACTORS
experimental facilities, 17: 28568
DIELECTRIC FILMS
radiation effects on photoconductivity of H-Film, 17: 27893 (TID-18843)
radiation effects on photoconductivity decay of Kel-F, 17: 27895 (TID-18857)
DIELECTRICS
evaluation of ceramic compositions as, 17: 27798 (RADC-TDR-62-307)
radiation effects on photoconductivity of, 17: 27893 (TID-18843)
radiation effects on photoconductivity decay of organic, 17: 27895 (TID-18857)
radiation effects on insulating properties of, 17: 27907
DIET
analysis for radium-226 content, 17: 27051
analysis for strontium-90, samples collected in 1962, 17: 27592(R) (HASL-138)
cesium-137 content of Lapps of Finland, 17: 27023
description of survival rations for use in nuclear warfare, 17: 27621
effect of maternal, on rate of radioinduced mutations in Drosophila, 17: 27102
effects of irradiated foods on *E. coli*, 17: 27027
radiosterilization of, for rearing germ-free guinea pigs, 17: 27004
shelter survival, nutritional evaluation, 17: 27612
survival, for shelters, psychologic aspects, 17: 27611
DIETHYLAMINE, 2,2'-DICHLORO-N-METHYL-
toxic effects of, protective effects of sodium diethyldithiocarbamate against, 17: 27030
DIETHYLAMINE, *N*-NITROSO-
carcinogenic effects of, combined with whole-body x irradiation in Wistar rats, 17: 27155
DIFFUSION
in gas-solid suspension flow in experimental loop, 17: 27541(R) (TID-18909)
in gas-solid suspension flow in experimental loop, 17: 27542(R) (TID-18910)
DIODES
emitter corrosion in thermionic, 17: 27964
emitter materials for noble-gas-plasma, development, 17: 27962
materials reactions in cesium vapor, 17: 27965
performance of flame-heated thermionic, 17: 27963
radiation effects nonequilibrium-carrier lifetime in silicon, neutron, 17: 27929(T)
thermal conductivity of cesium vapor in thermionic, 17: 27958
DIOXANE
electron emission in, point air-flow counter for exo-, 17: 27688
DIPHENYLAMINE, 2,2', 4,4', 6,6'-HEXANITRO-
solvent properties for cesium from wastes, 17: 28580 (HW-76222)
DISASTERS
book: *Medical Aspects of Radiation Accidents*, 17: 27632
cause-effect relationship in nuclear, legal viewpoint, 17: 26950
hospital organization for, 17: 27623
relief of hospitals from, 17: 27609
DISEASES
radioinduced allergic encephalomyelitis in rats, 17: 27124
DISPLACEMENT GAGES
design for inaccessible members, 17: 27676(P)
DOGS
magnesium metabolism, tracer study, 17: 27022
radiation effects on bacterial infection in, 17: 27204
radiation effects on freshly sutured bronchial stumps and esophageal anastomoses in, 17: 27127
radiation injuries in, effects on fibrinolytic activity in, 17: 27212
DROPS
deformation energy of charged, equilibrium configurations in, 17: 28262
formation and motion in two-phase flow, 17: 27543(R) (NYO-10486)
DROSOPHILA
genetic effects of x radiation compared with effects of nitrogen mustard, 17: 27099
mutations induced in populations, 17: 26977
radiation effects on, cosmic, 17: 27200
radiation effects on lethal mutations and chromosome crossovers, 17: 27064(R) (TID-18855)
radioinduced mutations, effect of maternal nutrition, 17: 27102
DRUGS
protective effects of Librium against radiation injury in mice, 17: 27189
DRY BOXES
design for reactive materials transfer, 17: 27514
DUSTS
pathological effects of rare metal, 17: 27603(T) (JPRS-19866)
DYSPROSIUM
partition coefficients and reciprocal ionic radii, 17: 27562 (INSJ-54)
DYSPROSIUM BORATES
crystal structure, 17: 27837
DYSPROSIUM OXIDES
entropy and heat content at 298 to 1800°K, 17: 27314 (BM-RI-6248)
spectra of, infrared absorption, 17: 27840

E

EARTH
heat balance of, photon rest mass as mechanism for, 17: 27578
partition coefficients and reciprocal ionic radii for elements during mantle formation, 17: 27562 (INSJ-54)
strontium-87–strontium-86 ratios in 45 rock units, as an index of geologic processes, 17: 27582
ECOLOGY
radio-, of Northern Alaska, 1961–62, 17: 27053 (HW-SA-3050)
review of radio-, 17: 27058 (NP-12897)
EGGS
heavy water effects in sea urchin, 17: 26975
radiation effects on development of transplanted mouse, 17: 27117
radiation effects on morphology of fertilized, in hamsters, 17: 27119
radiation effects on, of fruit flies, 17: 27120
radiosensitivity of developing mammalian, 17: 27090
ELASTICITY
measurement of Young's modulus above 2000°C, apparatus for, 17: 27361
ELASTOMERS
performance under simulated space conditions, 17: 27506 (NP-12906)
radiation effects on, bibliography on, 17: 27885 (AD-282467)
radiovulcanization of, role of free radicals in, 17: 27485
ELECTRIC ARC FURNACES
design of rotary multicrucible, engineering drawings for, 17: 27517
ELECTRIC ARCS
bibliography, 17: 28361 (NP-12921)
ELECTRIC CONDENSERS
photoconductivity of irradiated, 17: 27893 (TID-18843)
ELECTRIC DISCHARGE
gaseous, wall evaporation in pulsed, 17: 28027
in deuterium, production of short-time pulses of fast neutrons in, 17: 28329
oscillations in partially ionized gas, characteristics of, 17: 28380
oscillations in partially ionized gas, plasma instability from, 17: 28382
theory for, with low ion energies, 17: 27980
tori design for thermonuclear reaction studies, heavy, 17: 28403(P)
ELECTRIC FIELDS
particle trajectories in slowly varying, approximations for, 17: 28017
ELECTRIC POWER
generation from nuclear energy, apparatus and method for direct, 17: 28103(P)
generation from reactor heat, design of plant for direct, 17: 28560(P)
generation of, design of simplified radioactive system for, 17: 28578(P)
production by thermionic conversion, 17: 27954
ELECTRIC PROBES
bibliography, 17: 28361 (NP-12921)
development for flow regime detection, 17: 27543(R) (NYO-10486)
ELECTROCHEMICAL ANALYSIS
developments of, at Idaho Chemical Processing Plant, 17: 27231(R) (IDO-14605)
ELECTRODES
corrosion by cesium vapor, 17: 27965
ELECTRODYNAMICS

perturbation theory and Regge poles in, 17: 28217
ELECTROLYTIC CELLS
design and performance, 17: 27653 (IDO-16852)
ELECTROLYTIC SEPARATION PROCESSES
development of potentiostats for use in, 17: 27653 (IDO-16852)
ELECTROMAGNETIC FIELDS
effects on combustion wave propagation and ionization in gases, 17: 28014
measurement of, limitations to, 17: 27952(T) (UCRL-Trans-957(L))
ELECTROMAGNETIC LENSES
focusing and transmission properties of quadrupole systems of, graphical analysis of, 17: 28057
ELECTROMAGNETIC SHIELDING
structural mass for space vehicles, minimum, 17: 28410
ELECTROMAGNETIC WAVES
absorption by plasma, quasilinear approximation for, 17: 28399
charged particle and plasma containment by orthogonal standing, three-dimensional, 17: 28396
conversion to shock pulses, 17: 27947 (TID-18816)
effects of, on protein solution, effects of gamma rays on, 17: 27188
propagation from plasma-clad filament, 17: 28369
propagation in ionosphere and in plasmas, bibliography on, 17: 27937 (AID-62-155)
propagation in plasma in direction of impressed magnetic field, 17: 28398
scattering of, by high-energy electrons, 17: 28169
scattering of, by high-energy electron, 17: 28170
ELECTRON BEAMS
bunching characteristics of, in microtrons, 17: 28352
ELECTRON MICROSCOPY
analysis of effects of bismuth ingestion in rabbits, 17: 27021
of radioisotope-labeled materials coated with nuclear emulsion, 17: 27644
ELECTRON PAIRS
production in nuclei by gamma rays at 1–2 Mev, Z-dependence of cross sections for, 17: 28275
ELECTRON SOURCES
electromagnetic radiation from plasma-clad, 17: 28369
ELECTRONIC EQUIPMENT
design for suppression of photomultiplier noise, 17: 27657 (UCRL-6886(Rev.1))
performance under simulated space conditions, 17: 27506 (NP-12906)
radiation effects on components, 17: 27919
radiation effects on, 17: 26944(R) (BMI-1630(Del.))
ELECTRONS
affinities for nuclei $1 \leq A \leq 12$, relativistic and nonrelativistic, 17: 27996
annihilation on polarized positrons, cross sections, 17: 28214
behavior in ionized gaseous mixtures, 17: 27650(R) (AD-297382)
content in equatorial ionosphere, total, 17: 27941 (NASA-TN-D-1756)
correlation energies in beryllium atoms, 17: 28049
densities and temperatures in plasma diffusion from line source in magnetic field, 17: 28365 (UCRL-10801)
density distribution in phase lattices of transition metal nitrides during sintering, 17: 27767
density in hollow plasma, from electrostatic resonances, 17: 28374
density in ionosphere, 17: 28060
density in remote magnetosphere, whistler measurements for, 17: 28020
density of, gas laser for measuring, 17: 28367
density of ≥ 40 kev, in outer magnetosphere, 17: 28123
density profiles in lower ionosphere, radio absorption for, 17: 28018
dose factors for cylinder irradiations, 17: 28009
dosimetry of 1-Mev, in polyethylene using silicon solar cell, 17: 27696
electromagnetic radiation scattering by high-energy, 17: 28169
electromagnetic radiation scattering by high-energy, 17: 28170
emission in proton reactions with helium and hydrogen, angular distribution and energy for, 17: 28048
emission of exo-, point air-flow counter for, 17: 27688
energies in diatomic molecules, automatic computation of, 17: 27360
energy distributions in plasma, free spherical probe for measurement of, 17: 28376(T)
interactions in gases of, renormalization constant for, 17: 28377
interactions of, diagrams for photon exchange and interactions in, 17: 28166
interactions with electrons and holes in alkali and transition metals, electrical and thermal conductivity effects of, 17: 27923
motion in gas mixture, 17: 28357(R) (AD-290086)
paramagnetic resonance spectra of hydrated, 17: 27435
plasma, interactions with charged particles, 17: 28384
reactions with cesium atoms in plasma, cross sections for, 17: 27955
reactions with gold foils at 25–100 kev, optical bremsstrahlung and transition radiation from, 17: 28313
reactions with nuclei, book on, 17: 28345
scattering by hydrogen, excitation cross sections in, 17: 28067
scattering by liquid-like binary, description of, 17: 28137 (BNL-6364)
scattering on nuclei at high energies, isospin selection rules for inelastic, 17: 28326
spin resonance in neutron-irradiated diamonds, 17: 27918
spin resonance in gamma-irradiated carbohydrates, 17: 27454
temperature in ionosphere, from solar ultraviolet radiation, 17: 28115
transport in cesium plasma, 17: 27956
tunneling between superconductors, two-particle, 17: 28037
wave functions for hydrogen and methane molecules, one-center, 17: 27366
ELECTROPHORESIS
separation of radioisotopes by paper, in high electric fields, 17: 27445
ELECTROSTATIC GENERATORS
design and performance of high-pressure, for 2.3-Mev protons, 17: 28351
design for high-energy heavy-ions, 17: 28355(P)
uses in nuclear physics, 17: 27661
ELEMENTARY PARTICLES
conference, 17: 28138 (ISS-63/28)
distribution functions for mixture of, equations for reduced, 17: 28161
Green functions of many-body system of, Schwinger's functional method for, 17: 28201
interaction fields of spin-1, and symmetry properties, 17: 28143 (JINR-P-1241)
interactions at high energies, strong, 17: 28200
interactions of, global symmetries for, 17: 28175
interactions of, high-frequency behavior of reciprocal Green's function for, 17: 28178
interactions of, representation of matrix elements for vector operators in, 17: 28182
interactions of, theory of final-state, 17: 28136 (BNL-6363)
models for, 17: 28206
predictions of, Dirac and Kemmer equations for, 17: 28153 (NP-12904)
quantum mechanics of scalar, relativistic causality in, 17: 28141 (JINR-E-1252)
quantum numbers of hyperon resonances, system of pion-hyperon states for determining, 17: 28148 (JINR-P-1287)
scattering amplitudes for unstable, S-matrix theory for, 17: 28195
scattering of, theory of planar three-body, 17: 28177
theory of, quasioptical potential in model of quantum field, 17: 28146 (JINR-P-1253)
ELEMENTS
analysis of, theory and use of surface ionization mass spectrometric, 17: 27225 (AERE-R-4295)
beta particle scattering by, backscattering spectra from, 17: 28008
ELK RIVER POWER REACTOR
design, 17: 28547
EMBRYOS
radiation effects on development of hamster, 17: 27119
radiosensitivity of mouse, effects of age of mother, 17: 27169
ENDOCRINE GLANDS
morphological responses to foreign particles, 17: 26967
ENGINEERING TEST REACTOR
neutron spectra in, use of transport theory in analyzing, 17: 27730(R) (HW-77052)
ENZYMES
glutamate isomerase reactions, tracer study, 17: 26981
radiation effects on activity, in kidneys, 17: 27066 (USNRDL-TR-640)
radioinduced inactivation of proteinase and urease, 17: 27430
radiosensitivity of thymus mitochondria, 17: 27086
radiosensitivity of amino acids in proteinase, 17: 27429

reaction kinetics of hydrogenases, 17: 26983
EPITHELIUM
cytology of irradiated vaginal, 17: 27097
radiation effects on growth of gastrointestinal, 17: 27103
EQUIPMENT AND PROCEDURES
design for detecting nitrite in plutonium liquors, 17: 27222(P)
ERBIUM
partition coefficients and reciprocal ionic radii, 17: 27562 (INSJ-54)
ERBIUM BORATES
crystal structure, 17: 27837
ERBIUM ISOTOPES Er-167
neutron resonance cross sections, correction to Doppler broadening in, 17: 28307
ERBIUM OXIDES
spectra of, infrared absorption, 17: 27840
ERGOSTEROL
radiolysis of, formation of precalciferol in, 17: 27473
ERYTHROCYTES
effects of unknown agent on sedimentation rate of, in human blood, 17: 27128
effects of unknown agent on sedimentation rate of human, effects of lead shielding on, 17: 27129
iron metabolism in hemolytic disease, tracer study, 17: 27015
radiation effects on, in man, rabbits, and roosters, 17: 27166
ESCHERICHIA COLI
effects of irradiated foods on, 17: 27027
mutations, galactose, 17: 26980
radiation effects on cell division and growth in, 17: 27136
ESTRADIOL
effects of, on radiosensitivity of rats, 17: 27209
effects of, on sulfur-35 uptake by uterine structures in guinea pigs, 17: 27034
ESTROGENS
determination of, in tissues of broilers fed 3,4-dianisyl-2-*t*-3-hexene, use of tritium for, 17: 27050
effects of, on sulfur-35 uptake by uterine structures in guinea pigs, 17: 27034
ETHANE
heat of formation, 17: 27322 (UCRL-7301-T)
spectra of, carbon bond distance from infrared, 17: 27362
C_2H_6–C_2H_6, electron spin resonance studies of energy transfer in, 17: 27406 (RRL-113)
ETHANE, 1,1-DIFLUORO-
radioinduced polymerization, 17: 27470
ETHANETHIOL, 2-AMINO-
metabolism of, effects of, on radiosensitivity of animals, 17: 27047
protective effects against radioinduced hair dysplasia, in mice, 17: 27174
protective effects of, against toxicity of 2,2'-dichloro-*N*-methyldiethylamine, 17: 27030
protective effects against skin conductivity decreases in irradiated rabbits, 17: 27089
protective effects against radiation injuries to intestine in rats, 17: 27112
ETHANOL
electron emission in, point air-flow counter for exo-, 17: 27688
formation by radiolysis of propenediol in air and nitrogen, 17: 27424
ETHYLENE
radioinduced polymerization with tetrafluoroethylene, 17: 27476
radioinduced polymerization in aqueous silver salt solution, 17: 27478
C_2H_4–C_2H_4, electron spin resonance studies of energy transfer in, 17: 27406 (RRL-113)
ethylene–propene, radioinduced polymerization in aqueous silver salt solutions, 17: 27478
ETHYLENE, CHLORO- POLYMERS
radiation effects on photoconductivity decay of, 17: 27895 (TID-18857)
ETHYLENE, DICHLORO- POLYMERS
x-ray absorption in Saran film, 17: 27057 (MMPP-196-2)
ETHYLENE OXIDE POLYMERS
radioinduced crosslinking and degradation, 17: 27914
ETHYLENE POLYMERS
electric conductivity of, effects of heat treatment, iodine, and radiation on, 17: 27434
neutron diffusion lengths in, thermal, 17: 28437 (KAPL-2000-20)
neutron energy distribution and scattering cross section for cold, 17: 28437 (KAPL-2000-20)
radiation dosimetry in, using silicon solar cell, 17: 27696
radiation effects on photoconductivity decay of, 17: 27895 (TID-18857)
radioinduced thermoluminescence in, correlation with free radical concentration, 17: 27428
polyethylene–rubber, radiation effects on structure of, 17: 27931
ETHYLENE, TETRAFLUORO-
radioinduced polymerization with ethylene, isobutene, and propene, 17: 27476
ETHYLENE, TETRAFLUORO- POLYMERS
radiation effects on photoconductivity decay of Teflon, 17: 27895 (TID-18857)
wetting by hydrogen, contact angle for, 17: 28083
EUROPIUM
detection in presence of rare earths, spot test for, 17: 27300
partition coefficients and reciprocal ionic radii, 17: 27562 (INSJ-54)
EUROPIUM BORATES
crystal structure, 17: 27837
EUROPIUM BORIDES
electron structure and physical properties of crystals of, 17: 27875
properties as thermionic cathode, 17: 27966
EUROPIUM ISOTOPES Eu-154
neutron reactions (n,γ), gamma spectra from, 17: 28332
EUROPIUM OXIDES
spectra of, infrared absorption, 17: 27840
EVAPORATORS
design and performance of titanium, for uranium–plutonium liquors, 17: 27496
EXOSPHERE
emission of v-l-f noise in outer, mechanisms for, 17: 28016
EXPERIMENTAL BOILING WATER REACTOR
transfer functions of, synthesis as ratio of two complex polynomials, 17: 28490
EXPERIMENTAL GAS COOLED REACTOR
charge machine design, 17: 28497
pressure vessel strain measurements and analysis, 17: 28482 (TID-18888)
EXPERIMENTAL ORGANIC COOLED REACTOR
analytical methods for, 17: 27231(R) (IDO-14605)
EXPLOSIONS
uses in excavations, review, 17: 27504 (EUR-7.f)
EXPLOSIVES
detonation properties of condensed, thermodynamic, 17: 27374
EXPONENTIAL PILES
design and operation of JEEPNIK, 17: 28564 (KR-46)
reactivity measurement in highly subcritical range by digital cross-correlation technique, 17: 28444 (NP-12910)
EXTRACTION APPARATUS
operation of, longitudinal dispersion in two-phase continuous, 17: 27545
EYES
radiation effects on incidence of lesions in, 17: 27186
radiation effects on lens of, in rats, 17: 27139

F

FALLOUT
contamination of foods by, 17: 27606
content in grass, lichens, and moss, 17: 27604
hazards from nuclear explosion excavations, 17: 27504 (EUR-7.f)
monitoring at Ispra, Italy, 1961, 17: 27591 (EUR-223.i)
monitoring in animals and vegetation in Northern Alaska, 1961–62, 17: 27053 (HW-SA-3050)
monitoring in Lago Maggiore, 1958 through 1961, 17: 27588 (CNI-109)
monitoring in Poland, 1959 through 1961, 17: 27587 (CLOR-15)
monitoring of beta activity from Kiwi-A reactor test at Nevada Test Site in rabbits and rodents, 17: 27054 (TID-18864)
monitoring, 1962, 17: 27592(R) (HASL-138)
FAST FISSION
data on, 17: 28245 (KFK-120)

FAST REACTORS
fuel for breeder, evaluation of fused plutonium and uranium chlorides as, 17: 27797 (PAN-414/V)
materials for, neutron cross sections and fission data for, 17: 28245 (KFK-120)
physics of thorium-fueled, 17: 28451 (TID-7650(p.57-75))
problems of breeders, 17: 28544
FATTY ACIDS
analysis of iodine-131 labeled triolein, chromatographic, 17: 26984
sorption of triolein in health and disease, tracer study, 17: 26984
sorption studies of, using iodine-131-triolein, 17: 26984
FERMI FAST BREEDER REACTOR
breeding blanket head-loss testing, 17: 28445 (NP-12925)
fuel element fabrication for, process developments in, 17: 28531 (ORNL-3437)
FERMIONS
annihilation operators for, periodic-function representation of, 17: 28180
Green functions of condensed system of, functional method for solving, 17: 28201
theory of superconducting and superfluid fluids of, 17: 28069
FERRITES
magnetic properties and structure of silver lanthanum ferrite, 17: 27333
FERROMAGNETIC MATERIALS
magnetic properties and structure of silver lanthanum ferrite, 17: 27333
FERTILIZERS
analysis for calcium and phosphate ions by double-decomposition radio-release technique, 17: 27233(R) (ORO-588)
FETUSES
cesium metabolism in rat, tracer study, 17: 27036
development from transplanted irradiated or non-irradiated oocytes in irradiated or non-irradiated recipient mice, 17: 27117
radiation effects of exposure of pregnant mice on, 17: 27106
FIBRINOGEN
radiation effects on activity of, in dogs, 17: 27212
use of iodine-131-labeled human, for tumor localization in man and rats, 17: 26992
FIELD THEORY
bosce eigenstates in generalized, 17: 28153 (NP-12904)
canonical commutation relations in local, uniqueness of, 17: 28023
canonical commutation relations for infinite free Bose gas in nonrelativistic, representation of, 17: 28179
charge space, analysis, 17: 28174
dispersion relations in, integral representations of, 17: 28213
elementary particle models in, 17: 28206
field model with no reactions or scattering, quantum, 17: 28022
gravitational central-symmetric fields in, 17: 28064
model of, quasioptical potential in, 17: 28146 (JINR-P-1253)
spectral representations of inelastic amplitudes in, 17: 28209
two-point function of relativistic quantum, structure of, 17: 28021
FILTERS
testing of high-efficiency, development of fluorescent aerosol for, 17: 26944(R) (BMI-1630(Del.))
FINLAND
cesium-137 content of people and diet, 17: 27023
FISSION PRODUCTS
content in grass, lichens, and moss, 17: 27604
deposition from irradiated fuel to out-of-pile gas loop, 17: 26944(R) (BMI-1630(Del.))
detection in reactor effluents, system design for, 17: 28515(P)
diffusion from irradiated Zircaloy-2-clad, defected, swaged uranium dioxide rods, 17: 27890 (HW-62762)
effects on response of semiconductor detectors, 17: 27702
pressure measurements of gaseous, in operating fuel elements, development of instrument for, 17: 27651 (GEAP-4135)
recoil into ceramic materials, analysis of stresses from, 17: 27888 (BMI-1635)
release of gaseous, from irradiated uranium nitride, 17: 26944(R) (BMI-1630(Del.))
release of gaseous, from irradiated coated fuel particles, 17: 26944(R) (BMI-1630(Del.))
release of gaseous, during uranium dioxide irradiation, 17: 28429(R) (GEAP-3771-5)
removal effects on costs of waste management of liquids and solids, 17: 28583 (ORNL-3357)
separation from plutonium by ion exchange on zirconium phosphate silicate 17: 27499
yields from thermonuclear explosions, 17: 28260 (USNRDL-TR-642)
FISSION RECOILS
chemical state of iodine-131 diffused from thorium dioxide and uranium dioxide into graphite, 17: 27999
tracks in crystals, 17: 26944(R) (BMI-1630(Del.))
FISSIUM
fissium–U, analysis for molybdenum, palladium, rhodium, ruthenium, and zirconium, 17: 27255
FLANGES
design for coupling dissimilar metal tubes, 17: 27529(P)
FLOWMETERS
properties of E-core flux-distortion type for sodium systems, 17: 27655 (NAA-SR-Memo-6117)
FLUID FLOW
book: *Magnetohydrodynamics*, 17: 28070
critical heat flux in forced-convection, superposition model for prediction of, 17: 27536 (GEAP-3961)
deflection of parallel plates by, 17: 27552
film thickness and holdup measurements in two-phase vertical annular, 17: 27534 (AERE-M-1203)
heat transfer to boiling, in annular tubes and rectangular channels, 17: 27537 (NASA-TN-D-1656)
kinetics and mechanisms of jet propulsion, 17: 27538(R) (NP-12767)
measurement of, noncontaminating tracer method for, 17: 27680(P)
of gas-solid suspension in experimental loop, 17: 27541(R) (TID-18909)
of gas-solid suspension in experimental loop, 17: 27542(R) (TID-18910)
patterns and stability of two-phase, 17: 27543(R) (NYO-10486)
two-phase, longitudinal dispersion in continuous flow operations in, 17: 27545
two-phase, solutions for choking, 17: 28097
velocity in parallel magnetic field, instability of surface of discontinuity of, 17: 28013
void fractions for boiling heavy water in vertical pipes, 17: 27532 (AE-106)
FLUID FLOW (LAMINAR)
magnetohydrodynamic, in rectangular tube at high Hartmann number, 17: 28015
FLUID FLOW (TURBULENT)
heat transfer in, in circular tube with variable circumferential heat flux, 17: 27547
heat transfer in, in annular passages, 17: 27549
FLUID FUEL REACTORS
design concepts of thorium-fueled, 17: 28457 (TID-7650(p.194-209))
design concepts of liquid-metal breeder, 17: 28458 (TID-7650(p.210-43))
FLUID PROPELLANTS
kinetics and mechanisms of jet propulsion, 17: 27538(R) (NP-12767)
performance under simulated space conditions, 17: 27506 (NP-12906)
FLUIDIZATION
stability of homogeneous fluidized beds, 17: 27325(T) (AERE-Trans-942)
FLUIDS
cryogenic, hazards in handling of, 17: 28081
flow of weakly dissipative, shock conditions for magnetodynamic, 17: 28005
motion of plate in, vortex street development in, 17: 27553
theory of superconducting and superfluid Fermi, 17: 28069
FLUORESCEIN, DIIODO-
use of iodine-131-labeled, for diagnosis of cervical and ovarian tumors, 17: 26995
use of iodine-131-labeled, for tumor localization in man and rats, 17: 26992
FLUORESCENCE
radiation transfer into, calculation of, 17: 28004
FLUORIDE IONS
polymerization effects on tetravalent plutonium in acid media, 17: 27319 (ORNL-TM-585)
FLUORIDES

determination, radiochemical, 17: 27254
effects of, on calcium-45 and strontium-85 uptake by bones in rats, 17: 27044
FLUORINE
determination in gases, photometric analyzer for, 17: 27251
determination in urine, water, and foods, 17: 27589 (CNI-111)
FLUORINE IONS
electron affinities of, relativistic and nonrelativistic, 17: 27996
FLUORINE ISOTOPES F-18
half life, 17: 28250 (UCRL-10512)
FLUORINE ISOTOPES F-19
energy levels of, spin values for, 17: 28290
neutron reactions (n,γ) with, properties as resonance neutron detector, 17: 28237 (AE-102)
neutron reactions (n,p) with, properties for neutron threshold detectors, 17: 28237 (AE-102)
nuclear magnetic resonance in xenon fluorides, 17: 27744
proton reactions (p,α) with, energy levels of neon-19 excited in, 17: 28298
FOLIC ACID
protective effects against radiation injuries in guinea pigs, 17: 27082
protective effects against radiation injuries in guinea pigs, 17: 27083
FOOD
analysis for cesium-137, 17: 27277
analysis for fluorine, 17: 27589 (CNI-111)
analysis for strontium-90, radiochemical, 17: 27276
contamination by fallout, 17: 27606
description of disaster rations for hospitals, 17: 27609
fallout levels in Italian, 1961, 17: 27591 (EUR-223.i)
pesticide residue removal from, tracer techniques for evaluating, 17: 27638 (SAN-1021)
radiosterilization of beef, prevention of off-flavor in, 17: 27648(P)
radiosterilization of, method and uses of, 17: 27011
washing of, tracer studies of detergent residues in, 17: 27637 (SAN-1020)
FORMALDEHYDE POLYMERS
production by ionizing radiation, process for, 17: 27486(P)
FRANCE
lead-210, polonium-210, and radium-226 content in patients at Luchon, gamma spectra of, 17: 27042
measurement of natural radioactivity in Paris region, 17: 27567
uranium market in, in 1962, 17: 26952
FRANCIUM ISOTOPES Fr-223
separation from actinium-227 decay products by paper electrophoresis, 17: 27445
FREE RADICALS
contribution in lung cancer induction, 17: 27622
electron spin resonance studies of peroxide, in irradiated polypropylene, 17: 27450
reactions of polymer, with diphenylpicrylhydrazyl, 17: 27215
reactions with sulfur, 17: 27438
role in radiovulcanization of elastomers, 17: 27485
FRICTION
in gas-solid suspension flow in experimental loop, 17: 27541(R) (TID-18909)
in gas-solid suspension flow in experimental loop, 17: 27542(R) (TID-18910)
FROGS
phosphorus-32 effects on differentiation and growth of tadpoles, 17: 27072
FRUITS
radiopasteurization of, engineering drawings of mobile gamma irradiator for, 17: 27672
radiosterilization of raspberries and strawberries, effects of, on storage, 17: 27096
FUNGI
mutations in *Aspergillus fumigatus*, 17: 26978
radiation effects on *Rhizopus stolonifer*, recovery from, 17: 27118
ultraviolet radiation effects on luminescence in *Armillaria mellea* cultures, 17: 27179
FURNACES
blast, use of cobalt-60 for control of filling level in, 17: 27641
use of arc-image, for single-crystal growth, 17: 27515

G

GADOLINIUM
partition coefficients and reciprocal ionic radii, 17: 27562 (INSJ-54)
GADOLINIUM BORATES
crystal structure, 17: 27837
GADOLINIUM BORIDES
electron structure and physical properties of crystals of, 17: 27875
GADOLINIUM ISOTOPES Gd-152
energy level scheme, 17: 28305
GADOLINIUM OXIDES
spectra of, infrared absorption, 17: 27840
GADOLINIUM SILICIDES
production of, conditions for, 17: 27736
structure of, 17: 27736
GAGES
development of radiation-attenuation, for use in geophysics research, 17: 27564(R) (NYO-10219)
display device for cyclically checking numerous points, 17: 27679(P)
GALACTOSE
radiation effects on, electron spin resonance investigations of gamma, 17: 27454
GALAXIES
civilizations in Milky Way, relativistic space flight for contact with, 17: 26959
explosion in center of M82, 17: 28106
radiation from Milky Way, time variation of low-energy, 17: 28130
radio emission in Milky Way, disk component of, 17: 28107
GALLIUM
determination in SAP, x-ray spectrographic, 17: 27226 (EUR-21.f)
solvent properties for uranium, 17: 27394
spectra in reaction zone of acetylene air flame, excitation of atomic, 17: 27371(T)
GALLIUM ALLOYS
Ga–Au, atomic number effects correction in electron probe microanalysis of, 17: 27268
Ga–In, use as gamma source, 17: 28500
Ga–In–Sn, use as gamma source, 17: 28500
Ga–V, mechanical constraint effects on superconducting transitions of niobium wires coated with, 17: 28098
GALLIUM ARSENIDES
radiation effects electric conductivity and Hall effect in, gamma, 17: 27908
GAMMA-ABSORPTION ANALYSIS
method of, for fuel elements, 17: 27291
GAMMA CAMERAS
design modification for visualization of radioisotopes *in vivo*, 17: 27001
performance in radioisotope scanning, 17: 27002
GAMMA RADIATION
biological effects on rats, effects of dose rates on, 17: 27143
carcinogenetic effects of, on animals and man, 17: 27187
detection and measurement to 10,000 r, photographic film development techniques for, 17: 27594 (NBS-TN-161)
detection and measurement of high-intensity, in small area, effectiveness of aerial survey, 17: 26945 (CEX-62.6.2)
detection and measurement of, design of monitors for high- and low-level in-cell, 17: 27684 (HW-67376)
dosimetry of, flux-to-dose rate conversion factors for, 17: 27593 (JPL-TR-32-439)
effects on amino acids in proteinase, 17: 27429
effects on bones of rats from internally deposited strontium-89, 17: 27149
effects on cellular constituents of bone marrow and intestine in rats, late, 17: 27147
effects on chemical composition and physical properties of red seaweed, 17: 27132
effects on course of influenza virus infections in mice, whole-body exposure, 17: 27123
effects on effects of unknown agent on protein solution, 17: 27188
effects on eggs, larvae, and pupae of fruit flies, 17: 27120
effects on fungi, recovery from, 17: 27118
effects on reproduction in successive litters of rats, chronic exposure, 17: 27170
effects on root growth of Chenopodiaceae, Cruciferae, and Umbelliferae,

17: 27068(T) (CEA-tr-R-1678)
emission from aluminum alloys, stainless steels, and uranium after thermal neutron activation, 17: 27889 (EUR-103.f)
emission in proton reactions (p,γ) with oxygen-18 at 570–1500 kev, angular distributions from, 17: 28290
emission in proton reactions (p,α) with silicon-30 at 1177–1509 kev, angular correlations and distributions for, 17: 28321
emission in proton reactions (p,γ) with aluminum-27 at 980–1030 kev, spectra from 992-kev resonance in, 17: 28328
interactions with protons at 181 Mev, mesons (π^0) from, 17: 28204
luminescence induced in cell nuclear chemicals by, 17: 27065 (UCRL-10724)
measurement of, absorption method for, 17: 27698
production in space, experiments for determination of, 17: 28061
reactions (γ,p) with nitrogen-15 at 24.5 and 31 Mev, proton spectra from, 17: 28294
reactions with cesium iodide crystals, comparison with activator saturation model for scintillation efficiency from, 17: 27463
reactions with cesium iodide crystals; emission spectra and self-trapped holes in scintillations from, 17: 27464
reactions with nuclei at 1–2 Mev, electron pair cross section Z-dependence from, 17: 28275
scattering in laminar media, computer program, 17: 28196
sprout inhibiting effects on potatoes, 17: 27158

GAMMA SHIELDING
research program at HAPO on, review of, 17: 28408 (HW-SA-3032)

GAMMA SOURCES
design of cobalt-60 unit with shutter-type filter for, 17: 27008
design of cobalt-60, for biological research, 17: 27116
development of gallium–indium and gallium–indium–tin in-pile loops as, 17: 28500
development of mobile, for radiopasteurization of fruit, engineering drawings for, 17: 27672
radioactivity of, methods for determining, 17: 27462

GAMMA SPECTRA
emission in titanium-45 decay, 17: 28269

GAMMA SPECTROSCOPY
utilization in space research, 17: 27669

GAS ANALYZERS
design of continuous photometric, for fluorine determinations, 17: 27251

GAS COOLED REACTORS
coolant purification by electrostatic techniques, 17: 28484 (TID-18911)
coolant sampling system for, 17: 28507(P)
design of high-temperature, 17: 28552(P)
design of liquid moderated, with improved gas tube lattices, 17: 28518(P)
development for power production, 17: 28526(R) (DP-845)
energy conversion in, MHD, 17: 28548
physics of high-temperature, thorium-fueled, 17: 28454 (TID-7650 (p.128-47))
pump design for, small-flow, 17: 27524(P)

GAS FLOW
magnetogasdynamic boundary-layer, momentum integral approximation for compressible, 17: 28010

GASES
analysis by mass spectrometric methods, 17: 27423(R) (TID-18195)
canonical commutation relations for nonrelativistic infinite free Bose, representations of, 17: 28179
combustion wave propagation in, ionization in, 17: 28014
condensation in one-dimensional Bose, absence of Bose-Einstein, 17: 28181
diffusion in porous media, 17: 27860
electric conductivity of slightly ionized, 17: 28040
electric discharge in, wall evaporation in pulsed, 17: 28027
electric discharges in, characteristics of partially ionized, 17: 28380
handling system for radioactive reactor, 17: 28517(P)
hydrodynamic equations for dissipative processes in, relativistic, 17: 27939 (JINR-P-1261)
injection of, heat transfer in nucleate pool boiling simulation by, 17: 27550
interactions in electron, renormalization constant for, 17: 28377
kinetics, 17: 27539(R) (NP-12767(p.10–12))
kinetics and mechanisms of jet propulsion, 17: 27538(R) (NP-12767)
neutron transport theory in models for heavy, energy-dependent, 17: 28229
theory of imperfect, 17: 28024
transport coefficients of moderately dense, inverse power potentials in, 17: 28039

GASTROINTESTINAL TRACT
radiation effects on growth of epithelium, 17: 27103
radiation injury, 17: 27211
radiodiagnosis of diseases of, x-ray, 17: 26986

GEIGER-MUELLER TUBES
design of halogen, 17: 27690
use in point air-flow counter for exo-electrons, 17: 27688

GENERAL ELECTRIC TEST REACTOR
hazards evaluation for, 17: 28561 (APED-5000)
in-pile loop development and operation for testing uranium dioxide fuel in pressurized water, 17: 28429(R) (GEAP-3771-5)

GENETICS
factors influencing radiation protection by bone marrow, 17: 27206
factors influencing radiation protection by bone marrow, 17: 27207
radiation effects on, in man, 17: 27210
radiation effects on developing germ cells, 17: 27090
radiation effects compared with nitrogen mustard in Drosophila, 17: 27099
radioinduced changes in, review, 17: 27159
radioinduced sex-linked lethals, effect of chromosome number on, 17: 27098
review of radio-, 17: 27058 (NP-12897)

GEOCHEMISTRY
partition coefficients and reciprocal ionic radii for elements during formation of earth's mantle, 17: 27562 (INSJ-54)

GEOLOGY
age determination by rhenium method, 17: 27566(T) (AEC-tr-5858)
strontium-87–strontium-86 ratios in 45 rock units, as an index of geologic processes, 17: 27582

GEOMAGNETIC FIELDS
charged particle motion in perturbed and static, 17: 28131
disturbances from high-altitude explosions, two distinct synchronous, 17: 27576
effects on cosmic, galactic, and solar radiation, 17: 28130
electron and proton injection mechanisms and lifetimes in, 17: 28131
interactions with solar wind, interplanetary magnetic field effects on, 17: 27574
pulsations at auroral zone of, relation to ionospheric cosmic radio noise absorption, 17: 28016
solar flare effects on, data for 1962, 17: 28113
strength of remote magnetospheric, whistler measurements for, 17: 28020

GEOMAGNETIC STORMS
hydromagnetic emission during, properties of, 17: 27577
occurrence in magnetosphere, solar-wind flux interpretations for, 17: 28116
production of, trapped ion mechanism for, 17: 28125

GEOPHYSICS
cosmic ray reactions in, applications of isotopes produced by, 17: 28129
heat balance of the earth, photon rest mass as mechanism for, 17: 27578

GERMANIUM
analysis for copper and zinc traces, activation, 17: 27297
radiation-defect annealing in, 17: 27928(T)
wetting behavior of liquid, on solid beryllium, effects of atmosphere and temperature on, 17: 27795 (ORNL-3438)

GERMANIUM ALLOYS
Ge–Nb–Sn, superconducting properties of Nb_3SnGe, 17: 27861

GERMANIUM HYDRIDES
heat of explosion of Ge_2H_6, 17: 27322 (UCRL-7301-T)
heat of formation of GeH_4, Ge_2H_6, and Ge_3H_8, 17: 27322 (UCRL-7301-T)
SbH_3–Ge_2H_6, heat of explosion, 17: 27322 (UCRL-7301-T)

GERMANY
power reactor development in, 17: 28535

GLASS
performance under simulated space conditions, 17: 27506 (NP-12906)

GLOW DISCHARGES
bibliography, 17: 28361 (NP-12921)

device for low-pressure, design of, 17: 27994
GLUCOSE
radiation effects on metabolism of, 17: 27057 (MMPP-196-2)
radiation effects on, electron spin resonance investigations of gamma, 17: 27454
GLUTATHIONE
metabolism of, effects of, on radiosensitivity of animals, 17: 27047
protective effects of, against toxicity of 2,2'-dichloro-*N*-methyldiethylamine, 17: 27030
GLYCINE
formation in radiolysis of aqueous solutions of ammonium acetate, 17: 27473
GLYCINE SULFATES
radiation effects on dielectric behavior of, gamma, 17: 27916
GLYCOLYSIS
chemical and radiation effects on, in tumor cells, 17: 27035
GOLD
beta emission by, determination of end-point energy, 17: 28183
corrosion by cesium vapor, 17: 27965
determination as impurity in bismuth, spectrographic, 17: 27309
determination in biological materials, activation, 17: 27267
electric conductivity, effects of vacancy-impurity pairs on, 17: 27776 (BNL-6358)
gamma reactions at 1–2 Mev, electron pair cross section Z-dependence from, 17: 28275
oxygen-16 reactions at 167 Mev, charged-particle yields in, 17: 28252 (UCRL-10693)
reactions with oxygen-16 at 142 and 164 Mev, neutron production in, 17: 28251 (UCRL-10689)
use as tracer for activation analysis of cotton, 17: 27634(R) (NCSC-2477-4)
wetting behavior of liquid, on solid beryllium, effects of atmosphere and temperature on, 17: 27795 (ORNL-3438)
xenon-133 ranges and retention at 1–150 kev, energy and flux dependence of, 17: 28002
GOLD ALLOYS
Au–Ag, atomic number effects correction in electron probe microanalysis of, 17: 27268
Au–Mn, atomic number effects correction in electron probe microanalysis of, 17: 27268
Cs–Au, electric conductivity, Hall constant, and Seebeck coefficient of semiconducting, 17: 27872
Cu–Au, atomic number effects correction in electron probe microanalysis of, 17: 27268
Cu–Au, corrosion by cesium vapor, 17: 27965
Cu–Au, radiation disordering mechanism for, 17: 27892 (NAA-SR-Memo-504)
Ga–Au, atomic number effects correction in electron probe microanalysis of, 17: 27268
GOLD FOILS
argon reactions at 100 ev, dislocation dipoles and loops from, 17: 27920
electron reactions at 25–100 kev, optical bremsstrahlung and transition radiation from, 17: 28313
GOLD ISOTOPES Au-197
half life of isomeric, 17: 28237 (AE-102)
neutron reactions (n,n') with, properties as neutron threshold detector, 17: 28237 (AE-102)
GOLD ISOTOPES Au-198
neutron capture cross section of, use in thermal neutron flux standard calibration, 17: 28232
GONADS
radiation effects on rat, pre-exposed to low doses, 17: 27137
radiation injuries, protective effects of acidophilus milk, 17: 27083
radiation treatment of ovaries, effects on breast cancer, 17: 27075
radiosensitivity of developing germ cells, 17: 27090
radiotherapy of gynecological cancer, review on history of, 17: 27012
radiotherapy of ovaries, evaluation of supervoltage, 17: 26973
tumors on female, use of iodine-131 and phosphorus-32 for diagnosis of, 17: 26995
GRANITES
analysis for thorium, 17: 27295
thorium occurrence in, 17: 28450 (TID-7650(p.29-56))
GRAPHITE
analysis for boron traces, emission spectrographic, 17: 27286
analysis for microimpurities in solid, spectrographic, 17: 27308
bonding to graphite, cementing process for, 17: 27770(P)
coating with hafnium, thorium, and zirconium oxides by vaporization, 17: 27727 (ASD-TDR-63-322)
compatibility with aluminum oxide, 17: 26944(R) (BMI-1630(Del.))
compatibility with zirconium oxide, 17: 26944(R) (BMI-1630(Del.))
cooling in pyrolytic, Ettinghausen, 17: 27820
creep and recovery in, transient, 17: 27866
diffusion of gases in, 17: 27860
diffusion of iodine-131 in, activation energy of, 17: 28000
fabrication of impermeable tubes of, 17: 27772(P)
permeability of, process for decreasing, 17: 27884(P)
preparation of impermeable, with improved oxidation resistance, 17: 27771(P)
production and properties of impermeable, 17: 27735(T) (AEC-tr-5838)
production of high-purity artificial, 17: 27742
radiation effects on microstructure of, neutron, 17: 27910
radiation effects on crystal structure of, 17: 27917
reactions with refractory oxides, mechanism for, 17: 27344
GRAPHITE (IMPREGNATED)
oxidation resistance, effects of phosphoric acid treatment, 17: 27771(P)
pore structure and properties, 17: 27782 (GA-3194)
GRAPHITE MODERATED REACTORS
core stabilization in, design of system for, 17: 28510(P)
moderator structure design for, 17: 28519(P)
GRASS
ignition by nuclear explosions, effects of burst heights and atmospheric conditions on, 17: 27945 (NP-12936)
radiation effects on chromosomes in root tips of *Avena sterilis*, 17: 27087
GRAVITATION
detection and measurement of properties of, limitations on, 17: 28065
fields of, inertial mass equivalence and radiation from accelerated charged particles in static homogeneous, 17: 27990
properties of central-symmetric fields of, 17: 28064
GREAT BRITAIN
radiation protection measures in, concept and status of, 17: 27631
uranium market in, in 1962, 17: 26952
GROUND
cosmic meson (μ) reactions at 1 to 10 Tev, cross sections, 17: 28133
GROUND WATERS
flow variation in Salentine Peninsula of Italy, tracer studies of seasonal, 17: 27565 (RT/GEO(63)-25)
GUINEA PIGS
production of germ-free, radiosterilization of diet for, 17: 27004

H

HAFNIUM
analysis for boron using curcumin, 17: 27265
determination in zirconium, activation, 17: 27289
partition coefficients and reciprocal ionic radii, 17: 27562 (INSJ-54)
separation from protactinium using arsenazo III and isoamyl alcohol, radiometric, 17: 27306
separation from zirconium, methods for, 17: 27401
HAFNIUM ALCOHOLATES
isopropoxide and t-butoxide, preparation and properties, 17: 27727 (ASD-TDR-63-322)
isopropoxide, infrared spectra, 17: 27727 (ASD-TDR-63-322)
isopropoxide, thermal decomposition in air, argon, helium, and nitrogen, 17: 27727 (ASD-TDR-63-322)
HAFNIUM ALLOYS
Hf–Nb–W, preparation and properties of, 17: 27779(R) (DRI-2102)
Hf–Ta–W, tensile properties of, 17: 27733(R) (NMI-2116)
Hf–Zr, corrosion by steam at 316 and 400°C, 17: 27728(R) (GEAP-4076)
HAFNIUM CARBIDES
bibliography on properties, 17: 27809 (UCRL-7284)
HAFNIUM NITRIDES
electron structure and physical properties of crystals of, 17: 27875
sintering of, electron density in phase lattices and optimal conditions for,

17: 27767
HAFNIUM OXIDES
deposition on graphite by vaporization of isopropoxides, 17: 27727 (ASD-TDR-63-322)
phase transformation at high temperatures, 17: 27876
HAIR
radioinduced dysplasia, protective effects of cysteamine in mice, 17: 27174
radioinduced epilation of, effects of radiation intensity on, 17: 27105
HALDEN BOILING REACTOR
dynamics of, computer model for, 17: 28529 (KR-45)
HALLAM POWER REACTOR
fuel element materials for, metallurgy of molybdenum–uranium alloy as, 17: 27790 (NAA-SR-Memo-8408)
HAMSTERS
radiation effects on blood of, 17: 27160
radiation effects on fertilized ova and embryo development, 17: 27119
HANDBOOKS AND MANUALS
analytical procedures at ICPP, 17: 27231(R) (IDO-14605)
catalog of radioisotopes and stable isotopes, ORNL, 17: 26961
for LASL automatic lens-designing code, 17: 27940 (LA-2877)
on laboratory experiments in radiobiology for college and advanced high school students, 17: 27061 (TID-18616)
on medical aspects of radiation accidents, 17: 27632
HANFORD PRODUCTION REACTORS (N)
corrosion and hydriding in, computer studies of, 17: 27730(R) (HW-77052)
fuel element manufacture for, quality control procedures in, 17: 28432 (HW-SA-3045)
pressure-tube testing for, 17: 27730(R) (HW-77052)
HARWELL SYNCHROTRON
magnets for, apparatus and methods for measuring characteristics of, 17: 28349 (NIRL/R/4)
HASTELLOY C
stress-corrosion cracking by boiler water at 500°F and sea water at 550°F, 17: 27749 (KAPL-M-CC-3)
welding of, for gas-loop development, 17: 27730(R) (HW-77052)
HASTELLOY R235
oxidation by air and nitrogen–oxygen at 1750 and 1850°F, 17: 28528(R) (IDO-28607)
HASTELLOY X
corrosion by flowing helium at 1038°C, 17: 27730(R) (HW-77052)
oxidation by air and nitrogen–oxygen at 1750 and 1850°F, 17: 28528(R) (IDO-28607)
oxidation rates in oxygen at 1000°C, 17: 27730(R) (HW-77052)
stress-corrosion cracking by boiler water at 500°F and sea water at 550°F, 17: 27749 (KAPL-M-CC-3)
welding of, for gas-loop development, 17: 27730(R) (HW-77052)
HAYNES 25 ALLOY
corrosion by flowing helium at 1038°C, 17: 27730(R) (HW-77052)
oxidation rates in oxygen at 1000°C, 17: 27730(R) (HW-77052)
welding of, for gas-loop development, 17: 27730(R) (HW-77052)
HEAD
radiation effects on rabbit, irritating, 17: 27070(T) (JPRS-19806)
tumors of, performance of radioisotope techniques for diagnosis of, 17: 26994
HEALTH PHYSICS
for radiobiology laboratories, 17: 27614
instrumentation developments in, at Ispra, 17: 27682 (EUR-14.i)
HEAT
conversion to electric power, conference on thermionic, 17: 27954
production by underground nuclear explosions, 17: 27505 (EUR-16.f)
HEAT EXCHANGERS
design of solid-ball, 17: 27559(P)
fabrication of tube-and-shell, method for joining headers to shell in, 17: 27558(P)
HEAT TRANSFER
burnout in 7-rod fuel bundle, effects of rod spacing on, 17: 28423(R) (DPST-63-69-6)
conductance of uranium dioxide/stainless steel interfaces, 17: 27546
from cylinder rotating in water, 17: 27533 (AE-107)
in annular passages, formulation of, 17: 27548
in circular tube with variable circumferential heat flux, turbulent, 17: 27547
in fuel assemblies, 17: 28533(R) (SRO-83)
in laminar fluid flow in annular passages, 17: 27549
in nucleate pool boiling simulated by gas injection at interface, 17: 27550
in superheaters, 17: 28522 (ACNP-62030)
to boiling water flowing in annular tubes and rectangular channels, 17: 27537 (NASA-TN-D-1656)
transient analysis in heterogeneous water reactor with exponential power increase, 17: 28496
HEAT TRANSFER SYSTEMS
conference on liquid metal, 17: 27535 (BNL-801)
design and operation of superheat strain-cycle, for evaluation of fuel element cladding, 17: 28430 (GEAP-3933)
development and operation of organic loop, 17: 28433(R) (IDO-11005)
research on liquid metal, 17: 27535 (BNL-801)
HEAVY WATER REACTORS
buckling and void effects in organic- or light-water-cooled, with uranium dioxide rod clusters, 17: 28483 (TID-18895)
buckling and voiding in, with uranium dioxide tube clusters, 17: 28526(R) (DP-845)
design for water desalinization, 17: 28499
development for desalination plants and power production, 17: 28526(R) (DP-845)
fuel element burnout testing in, effects of rod spacing on, 17: 28423(R) (DPST-63-69-6)
kinetics of reflector-perturbed, 17: 28436(R) (IDO-16890)
steam cycles for ORGEL, 17: 28424 (EUR-83.f)
HELIUM
compression of, second virial coefficients and volumetric behavior at 0 to −140°C, 17: 28077
cooling liquid hydrogen by injections of gaseous, 17: 28096
excited atomic states of, method for measuring lifetimes of, 17: 27943 (NP-12903)
flow in experimental loop, 17: 27541(R) (TID-18909)
flow in experimental loop, 17: 27542(R) (TID-18910)
ion reactions in gases of, charge transfer and ionization cross sections for 60–450 kev rare-gas, 17: 28054
neutron cross sections for, fast, 17: 28245 (KFK-120)
proton reactions at 50–150-kev, electron angular distribution and energy from, 17: 28048
proton scattering at 730 Mev, differential cross sections and polarizations for, 17: 28157 (UCRL-10637)
purification of reactor-coolant, by electrostatic techniques, 17: 28484 (TID-18911)
radioinduced formation in sintered beryllium oxide, 17: 27912
refrigeration by, design of closed-cycle cascade system for 4.4°K, 17: 28079
refrigeration by, design of closed-cycle system for 2.5°K, 17: 28080
use in space simulators, supply systems for, 17: 28078
use of gaseous and liquid, in space environment simulator, 17: 28075
HELIUM IONS
density in ionosphere, 17: 28060
electron affinities of, relativistic and nonrelativistic, 17: 27996
reactions in rare gases at 60–450 kev, charge transfer and ionization cross sections for, 17: 28054
yields in oxygen-16 reactions at 167 Mev, 17: 28252 (UCRL-10693)
HELIUM ISOTOPES He-3
Coulomb energy of, importance of symmetries in calculation of, 17: 28003
properties at low temperatures, 17: 28073
properties of liquid, at cryogenic temperatures, 17: 27804(R) (TID-18842)
viscosity of liquid, at 0.14–2.1°K, 17: 28036
HELIUM SYSTEMS
Cs–He, cesium ionization transients from electric discharges in, 17: 28043
He–N, second virial coefficients and volumetric behavior at 0 to −140°C, 17: 28077
He–Ne, plasma electron density measurements with lasers of, 17: 28367
HEMATOLOGY
radiation protection and, 17: 27161
HEMOGLOBIN

radiation effects on mouse, continuous, 17: 27148
HENDECANE
polarization of irradiated, high voltage relaxation, 17: 27469
HEPTANE
polarization of irradiated, high voltage relaxation, 17: 27469
radioinduced reactions of, with carbon dioxide, yields in, 17: 27458
HEPTANE, 2,2,4,6,6-PENTAMETHYL-
radiolysis, 17: 27465
HETEROGENEOUS REACTORS
fuel rod lattice design for, 17: 28520(P)
HEXANE
polarization of irradiated, high voltage relaxation, 17: 27469
solvent properties for terphenyls, 17: 27423(R) (TID-18195)
HIGH-ALTITUDE EXPLOSIONS
magnetic effects of, two distinct synchronous, 17: 27576
production of infrared radiation by, 17: 27573
thermal effects on materials at various burst heights and atmospheric conditions, 17: 27945 (NP-12936)
HIGH ENERGY INJECTION DEVICES
design, 17: 28405(P)
HIGH-PRESSURE SYSTEMS
design of compact cell for pressure studies at liquid helium temperatures, 17: 27666
HIGH TEMPERATURE GAS COOLED REACTOR EXPERIMENT
development of, review of, 17: 28534
fuel consumption rate in, calculations of, 17: 28459 (TID-7650(p. 244-52))
fuel element loading machine for, operation of inductive transmitters in, 17: 28539
iodine release in containment of, experimental testing of, 17: 28418 (AEEW-R-172)
HIGH TEMPERATURE SEPARATION PROCESSES
fused salt-liquid metal extraction, axial mixing and mass transfer in, 17: 27492 (BNL-791)
HOLMIUM
partition coefficients and reciprocal ionic radii, 17: 27562 (INSJ-54)
HOLMIUM BORATES
crystal structure, 17: 27837
HOLMIUM ISOTOPES Ho-165
coulomb excitation with oxygen-16 ions, energy levels in, 17: 28299
HOLMIUM ISOTOPES Ho-166
decay of 27-hr, beta and gamma spectra in, 17: 28291
neutron reactions (n,γ), gamma spectra from, 17: 28332
HOLMIUM OXIDES
spectra of, infrared absorption, 17: 27840
HOMOGENEOUS REACTORS
conversion factors of bare, 17: 28421 (CNAM-5)
properties as power breeder, 17: 28545
HOSPITALS
disaster relief in, programs for, 17: 27609
organization for disasters and warfare, 17: 27623
HYDRAULIC FLUIDS
performance under simulated space conditions, 17: 27506 (NP-12906)
HYDRAZINE
formation in radiolysis of ammonia, kinetics of, 17: 27472
preparation by fissiochemical process in in-pile loop, 17: 27414(R) (ASD-TR-7-840A(IX))
radiation effects, 17: 27414(R) (ASD-TR-7-840A(IX))
yields in ammonia radiolysis by deuterons, effects of rare gases on, 17: 27436
HYDRAZYL, DIPHENYLPICRYL-
reactions with polymer radicals, 17: 27215
HYDRIODIC ACID
heat of formation, 17: 27322 (UCRL-7301-T)
HYDROAROMATIC COMPOUNDS
properties of condensed polycyclic refinery product as reactor coolant, 17: 27404 (NAA-SR-Memo-7426)
HYDROBROMIC ACID
heat of formation, 17: 27322 (UCRL-7301-T)
HYDROCARBONS
acetylenic, radioinduced polymerization of, kinetics of, 17: 27477
nature of condensed, formed by hydrolysis of mixtures of mono and di-carbides of uranium in acid or neutral medium, 17: 27409
radioinduced reactions with cyanogen, 17: 27437
stability of fuel oils, improvement by irradiation, 17: 27647(P)
HYDROCHLORIC ACID
heat of formation, 17: 27322 (UCRL-7301-T)
reactions with magnesium and succinic acid, heats of, 17: 27323 (UCRL-7325-T)
HYDRODYNAMICS
equations for dissipative processes in gases, relativistic, 17: 27939 (JINR-P-1261)
stability of homogeneous fluidized beds, 17: 27325(T) (AERE-Trans-942)
HYDROFLUORIC ACID
heat of formation, 17: 27322 (UCRL-7301-T)
hyperfine structure and Stark effect in, 17: 27378
HYDROGEN
boiling heat-transfer data at standard and zero gravity, nucleate, 17: 28095
cooling liquid, by helium gas injection, 17: 28096
creep ductility effects on Magnox ZA before working, 17: 27848
deuterium exchange with ammonia, method for, 17: 27718(P)
deuterium exchange with water vapor at high temperatures and pressures, catalyst for, 17: 27719(P)
diffusion in beta-zirconium at 760 to 1010°C, coefficients for, 17: 27844
electric discharge in, Balmer lines intensity modulation in r-f, 17: 28026
electron scattering by, excitation cross sections in, 17: 28067
electron wave functions for molecules of, one-center, 17: 27366
exchange with deuterium in pentaborane catalyzed by 2,6-dimethylpyridine, 17: 27410
excitation and ionization of 10-Mev atoms, 17: 27950 (UCRL-10802)
flow of liquid, solid formation in, 17: 28084
flow of liquid-vapor mixtures of, solutions for choking, 17: 28097
insulation for airborne tanks of liquid, 17: 28086
insulation for airborne tanks of liquid, external, 17: 28087
insulation for airborne tanks of liquid, compressible external, 17: 28088
insulation for airborne tanks of liquid, internal, 17: 28089
intensity of ultraviolet sources of, 17: 28033(T)
ion reactions in gases of, charge transfer and ionization cross sections for 60–450 kev rare-gas, 17: 28054
isotopic exchange of hydrogen between water vapor and molecular, 17: 27326
level and mass gaging techniques for liquid, 17: 28085
motion in deuterated and natural potassium phosphate, 17: 27359
neutron cross sections for, fast, 17: 28245 (KFK-120)
neutron penetration at 8.1 Mev in slabs of, Monte Carlo calculations, 17: 28411
proton reactions at 100 kev, electron angular distribution and energy from, 17: 28048
pumping of, performance of inducer-impeller combination for, 17: 28093
radiation effects on sorption of, by nickel catalyst, 17: 27483
reactions with titanium–zirconium alloys, kinetics of, 17: 27347
refractive index of liquid para-, and normal, 17: 28035(T)
sorption by Magnox Zr 55 at 475 and 600°C, effects of heat treatment atmosphere on, 17: 27846
sorption by Zircaloy-2, 17: 27751 (WAPD-T-1567)
spectra of, Stark broadening of Balmer lines at low electron densities, 17: 27992
thermodynamic properties of para-, from 1 to 22°K, 17: 28076
ultraviolet refractive indices of gaseous, Rayleigh scattering method for vacuum, 17: 28029
wetting by, contact angles for, 17: 28083
work function reduction by, in thermionic cells, 17: 27972
yields in radiolysis of potassium dichromate in sulfuric acid, 17: 27466
HYDROGEN HALIDES
reaction with molybdenum–uranium alloys, 17: 27403(P)
HYDROGEN IONS
deuterium exchange with water, equilibrium constant, 17: 27380
electron affinities of, relativistic and nonrelativistic, 17: 27996
excited-state populations of neutral beams produced from, 17: 27950 (UCRL-10802)
HYDROGEN ISOTOPES
exchange between benzene and its derivatives and deuterium oxide, effects of nickel on, 17: 27384

exchange between deuterium oxide and anisole or xylene, effects of catalysts on, 17: 27387
exchange between deuterium oxide and propene, effects of nickel on, 17: 27390
exchange reactions between molecular hydrogen and water vapor, effects of nitrogen on, 17: 27326
separation factor in electrolytic evolution from platinum cathode, 17: 27716
HYDROGEN PEROXIDES
yields from irradiated alkaline solutions, 17: 27180
HYDROGEN SELENIDES
heat of formation, 17: 27322 (UCRL-7301-T)
H_2Se–H_2Te, heat of explosion, 17: 27322 (UCRL-7301-T)
HYDROGEN SULFIDES
heat of formation, 17: 27322 (UCRL-7301-T)
HYDROGEN TELLURIDES
heat of explosion of TeH_2, 17: 27322 (UCRL-7301-T)
heat of formation, 17: 27322 (UCRL-7301-T)
H_2Se–H_2Te, heat of explosion, 17: 27322 (UCRL-7301-T)
HYDROLOGY
use of oxygen-18/oxygen-16 ratio in ground water flow studies, 17: 27565 (RT/GEO(63)-25)
HYDROMAGNETIC WAVES
absorption by plasma, quasilinear approximation for, 17: 28399
attenuation of magnetoacoustic, relativistic analysis of, 17: 28066
emission during geomagnetic storms, properties of, 17: 27577
generation of transverse-drift, in inhomogeneous plasma, 17: 28400
propagation in inhomogeneous magnetic fields of constant direction, linear approximation for, 17: 27995
propagation in plasma near ion cyclotron resonance, 17: 28391
propagation in tubular plasma, 17: 28390
propagation of nonlinear one-dimensional, in magnetic fields, 17: 28401
HYDROXYLAMINES
N-benzoylphenyl-, use of acetate in separation of copper from cadmium and cobalt, 17: 27299
HYPERFINE STRUCTURE
theory of, book on, 17: 28345
HYPERONS
quantum numbers of, system of pion-hyperon states for determining, 17: 28148 (JINR-P-1287)
HYPERONS (Λ)
beta decay of, branching ratio for, 17: 28192
decay of, method for testing time-invariance by, 17: 28414
production in meson (π^-)-proton interactions, cross section and momentum spectrum for, 17: 28144 (JINR-P-1245)
HYPERONS (Σ)
interactions with mesons (π), production of resonance-state, 17: 28136 (BNL-6363)
interactions with mesons (K) and (π), resonance, 17: 28172
HYPERONS (Ξ)
parity and spin of, methods for determining, 17: 28150 (LNF-63/31)
HYPERTHYROIDISM
radiotherapy of, calculation of dose distribution for iodine-131, 17: 26965

I

ICE
thermal conductivity at 20–103°K, 17: 28082
ICE-*d*
thermal conductivity at 20–103°K, 17: 28082
IMMUNITY
antibody reactions to tumor homografts, 17: 26987
graft-host interactions in mice, 17: 27122
radiation effects on immune responses, 17: 27121
reaction to transplanted bone marrow or lymph node cells, 17: 26971
reactions of, effects on radiosensitivity of tumor cells, 17: 27142
IMPACT SHOCK
absorber design for, 17: 28505(P)
production of, electromagnetic device for, 17: 27947 (TID-18816)
IN-PILE LOOPS
description of, at Harwell, 17: 28568
development and operation of pressurized water, for uranium dioxide fuel testing, 17: 28429(R) (GEAP-3771-5)
development of, for hydrogen production, 17: 27414(R) (ASD-TR-7-840A(IX))
use of gallium–indium and gallium–indium–tin, as gamma sources, 17: 28500
INCINERATORS
construction of, for radioactive waste processing, 17: 28579 (EURAEC-295)
INCONEL
oxidation of types 600, 604, and 702, by air and nitrogen–oxygen at 1750 and 1850°F, 17: 28528(R) (IDO-28607)
radiation effects on, 17: 27730(R) (HW-77052)
stress-corrosion cracking by boiler water at 500°F and sea water at 550°F, 17: 27749 (KAPL-M-CC-3)
wetting by hydrogen, contact angle for, 17: 28083
INCONEL X
stress-corrosion cracking by boiler water at 500°F and sea water at 550°F, 17: 27749 (KAPL-M-CC-3)
INDIA
uranium market in, in 1962, 17: 26952
INDIAN POINT POWER REACTOR
fuel element testing, 17: 28475 (TID-7650(p.630-42))
INDIUM
determination as impurity in bismuth, spectrographic, 17: 27309
determination using rhodamine C, 17: 27303
neutron activation rates for, fast, 17: 28221 (EUR-107.f)
photon reactions with, proton angular distributions and yields at >8 Mev, 17: 28265
separation from tin, methods for, 17: 27401
solvent properties for uranium, 17: 27394
spectra in reaction zone of acetylene air flame, excitation of atomic, 17: 27371(T)
INDIUM ALLOYS
critical temperature of superconducting, impurity effects on, 17: 28044
Ga–In, use as gamma source, 17: 28500
Ga–In–Sn, use as gamma source, 17: 28500
In–Pu, phase studies, 17: 28565(R) (LAMS-2915)
In–Sb, electron and hole mobility in, 17: 27831
In–Sn, superconducting transition temperatures in, 17: 28047
INDIUM ARSENIDES
InAs–InP, microhardness composition-dependence in, 17: 27874
INDIUM ISOTOPES In-116
isomers of, characteristics of, 17: 28310
INDIUM OXIDES
incorporation into uranium dioxide lattice, 17: 27487
INDIUM PHOSPHIDES
InAs–InP, microhardness composition-dependence in, 17: 27874
5-INDOLOL, 3-(2-AMINOETHYL)-
protective effects against lethal radiation injuries in mice, 17: 27154
radiation effects on content in brain of rats and mice, 17: 27110
INDUSTRIAL HYGIENE
in rare metal ore mines, 17: 27603(T) (JPRS-19866)
INFECTIONS
radiation effects on bacterial, in dogs, 17: 27204
radiation effects on course of influenza virus, whole-body exposure, 17: 27123
INFLUENZA VIRUS
radiation effects on, in mice, 17: 27123
INFORMATION RETRIEVAL SYSTEMS
descriptors for two-phase automatic, for digital circuit modules, 17: 27724 (TID-18886)
read-back of precision-photographed data, 17: 26949 (TID-18887)
INFRARED RADIATION
background for aerial observation of earth, conference, 17: 27563 (NP-12932)
production by high altitude nuclear explosion, 17: 27573
INFRARED SPECTROSCOPY
use in stress detection, feasibility of, 17: 27508 (SCTM-59-63(25))
utilization in space research, 17: 27669
INOR-8
corrosion by boiling niobium pentafluoride, 17: 26944(R) (BMI-1630 (Del.))

INSECTS
radiation effects on biological index in, cosmic, 17: 27196
radiation effects on eggs, larvae, and pupae of fruit flies gamma, 17: 27120
INSTRUMENTS
display device for cyclically checking numerous points, 17: 27679(P)
INSULIN
preparation of I^{131}-labeled, 17: 27032
INTERFEROMETERS
shock wave profiles in microwave, determination of longitudinal, 17: 27662
INTESTINE
iron transport in, tracer study, 17: 27040
radiation dose from internally-deposited radioisotopes, 17: 26964(R) (ORINS-42)
radiation effects on bacterial infection in, in dogs, 17: 27204
radiation effects on, from pelvic radiotherapy, 17: 27078
radiation effects on cellular constituents of, in rat, 17: 27147
radiation injuries of, protective effects of β-mercaptoethylamine and blood vessel clamping on, 17: 27112
radiation injury, pathology, 17: 27205
radioinduced rectal lesions following radiotherapy of uterine cervical carcinoma, 17: 27183
INVERTASE
radiation effects in molecules, 17: 27114
IODINE
diffusion from single-crystal uranium carbide, 17: 27784 (GA-4267)
effects on electric conductivity of polyethylene, 17: 27434
ion exchange on resins, effects of boric acid and potassium hydroxide on, (WCAP-3716)
separation from air, design of equipment for, 17: 28579 (EURAEC-295)
IODINE ISOTOPES I-128
production from methyliodide by Szilard-Chalmers reaction, extraction yield from, 17: 27456
IODINE ISOTOPES I-131
analysis for impurities in biological solutions of, 17: 27247
content in animals and vegetation in Northern Alaska from fallout, 17: 27053 (HW-SA-3050)
content in milk and thyroid gland in Italy, 1961, 17: 27591 (EUR-223.i)
decay scheme, 17: 28303
diffusion in graphite, activation energy of, 17: 28000
incorporation into wool fibers, 17: 27216
radiation dose to thyroid gland from, in therapy for hyperthyroidism, 17: 26965
recoil from thorium dioxide and uranium dioxide into graphite, chemical state in, 17: 27999
sampling with activated charcoal in chemical processing plant effluent, 17: 27417 (HW-77126)
separation from irradiated tellurium, chromatographic, 17: 27495
uptake by thyroid gland, protective effects of potassium iodide against, 17: 27607
uptake by thyroid gland in infants, 17: 27020
uptake of, by thyroid gland, effects of sodium perchlorate on, 17: 27048
use of, for diagnosis of thyroid tumors, 17: 26993
use of, for diagnosis of tumors in female genital organs, 17: 26995
ION BEAMS
bibliography on chemical processes in high-energy, 17: 27421 (NP-12894)
ION EXCHANGE MATERIALS
analysis for calcium and phosphate ions by double-decomposition radio-release technique, 17: 27233(R) (ORO-588)
preparation and properties of zirconium phosphate silicate, 17: 27499
ION EXCHANGE PROCESSES
development of scavenging-precipitation, for decontamination of process water wastes, 17: 28582 (ORNL-3322)
ION SOURCES
plasma properties in, in Kaufman-type engine, 17: 28360 (JPL-TR-32-417)
IONIZATION
distribution in cylinders irradiated with electrons, 17: 28009
IONIZATION CHAMBERS
design and performance of guarded-field cavity, for supervoltage radiation measurements, 17: 27163
design, for measurement of biological effectiveness of radiation, 17: 27056 (CERN-63-17)
design of circuit integrating dose in x ray therapy, 17: 27164
design of electrostatically-charged, 17: 27711(P)
design of miniature tissue equivalent, for biological samples, 17: 27076
design of muscle-equivalent, for environment monitoring, 17: 27706
measurement of stem leakage in, 17: 27699
IONOSPHERE
absorption of cosmic radio noise, relation to auroral chorus activity and K-index, 17: 28122
atmospheric density in E-region of, 17: 28051
cosmic radio noise absorption in, relation to auroral zone chorus, 17: 28016
electric current patterns in high latitudes of, 17: 28019
electron content in equatorial, total, 17: 27941 (NASA-TN-D-1756)
electron-density profiles in lower, radio absorption for, 17: 28018
electron temperatures in, from solar ultraviolet radiation, 17: 28115
properties of D, E, F, and upper regions of, satellite data comparison to theoretical models for, 17: 28060
IONS
acceleration of heavy, electrostatic, 17: 28355(P)
content and production rate in lower ionosphere, 17: 28060
cyclotron resonance in plasma, detection system for, 17: 28383
densities and temperatures in plasma diffusion from line source in magnetic field, 17: 28365 (UCRL-10801)
energy distributions in plasma, free spherical probe for measurement of, 17: 28376(T)
injection into plasma, device for, 17: 28405(P)
quantum number for plasma, maximum bound principal, 17: 28363 (UCRL-6981-T(Rev.I))
reactions of heavy, with nuclei, 17: 28258 (UCRL-10775)
reactions with complex nuclei, product charge distribution from, 17: 28253 (UCRL-10741)
reactions with nuclei, properties of isomeric states of thallium produced in, 17: 28255 (UCRL-10764)
scattering of heavy, equivalence of optical model and phase shift analyses for, 17: 27949 (UCRL-10769)
sequestration of metal, in brines, tracer studies of, 17: 27320(R) (ORO-602)
IRIDIUM
work function, 17: 27970
IRIDIUM ISOTOPES Ir-186
separation from alpha-irradiation rhenium by electrolysis, 17: 27459
IRIDIUM ISOTOPES Ir-188
separation from alpha-irradiation rhenium by electrolysis, 17: 27459
IRON
analysis for water during sintering by neutron scattering, 17: 27282
catalytic effects on ammonia synthesis, 17: 27385
deformation of, stored-energy release in, 17: 27783(R) (GA-4227)
determination as impurity in bismuth, spectrographic, 17: 27309
determination in carbonatites, spectrographic, 17: 27228 (EUR-32.f)
determination in Magnox MN 70, spectrophotometric, 17: 27234 (PG-Report-437)
determination in Magnox AL-80 and ZR-55, spectrophotometric, 17: 27236 (PG-Report-453)
determination in polyphenyls, x-ray spectrographic, 17: 27227 (EUR-28.f)
determination in SAP, x-ray spectrographic, 17: 27226 (EUR-21.f)
determination in stainless steel microspheres, activation, 17: 27253
distribution in Zircaloy-2 and zirconium oxide, use of electron microprobe for determination of, 17: 27746(R) (DPST-63-71-1)
energy levels, 17: 27057 (MMPP-196-2)
metabolism by erythrocytes in hemolytic disease, tracer study, 17: 27015
neutron cross sections for, fast, 17: 28245 (KFK-120)
photon reactions with, proton angular distributions and yields at >8 Mev, 17: 28265
proton scattering at 730 Mev, differential cross sections and polarizations for, 17: 28157 (UCRL-10637)
separation from protactinium using arsenazo III and isoamyl alcohol, radiometric, 17: 27306
separation from thorium using liquid-metal extraction, 17: 28465 (TID-7650(p.436-53))

separation of uranium from, by anion exchange, 17: 27296
sorption by intestine, tracer study, 17: 27040
spectra in reaction zone of acetylene air flame, excitation of atomic, 17: 27371(T)
spectra of, angular momentum distributions for, 17: 27938 (BNL-6396)
wear against carburized steel in argon and sodium at temperatures up to 1200°F, 17: 26944(R) (BMI-1630(Del.))
x-ray spectra of, using promethium-147 beta source, 17: 27280

IRON ALLOYS
Al–Fe–Ni, corrosion by water at 330°C, 17: 27730(R) (HW-77052)
Be–Fe, heat treatment for improved properties of, 17: 27883(P)
Cr–Fe, ferromagnetism and atomic magnetic moments of, effects of solute concentration on, 17: 27801 (TID-17141)
Cr–Fe–Mo–Ni, stress-corrosion cracking by boiler water at 500°F and sea water at 550°F, 17: 27749 (KAPL-M-CC-3)
Cr–Fe–Ni, stress-corrosion cracking by boiler water at 500°F and sea water at 550°F, 17: 27749 (KAPL-M-CC-3)
Fe–Pu, analysis of, 17: 27789(R) (MLM-1156)
Fe–V, ferromagnetism and atomic magnetic moments of, effects of solute concentration on, 17: 27801 (TID-17141)
Fe–V, thermodynamic properties at 1400 to 1800°K, 17: 27774 (ANL-6657)

IRON(III) CHLORIDES
effects on radiolysis of acrylonitrile in *N,N*-dimethylformamide, 17: 27467

IRON FILMS
superconductivity, 17: 28046

IRON(II) IONS
reactions with plutonium(VI) ions at 0 to 25°C, 17: 27316 (LADC-5517)

IRON(III) IONS
effects on phosphorus-32 sorption by lead and strontium sulfates, 17: 27363

IRON ISOTOPES
deuteron reactions (d,n) on, distributions from, 17: 28335
proton reactions at 150 Mev on, spallation cross sections in, 17: 28334

IRON ISOTOPES Fe-54
alpha reactions (α,p) at 22 Mev, angular distributions from, 17: 28288

IRON ISOTOPES Fe-55
decay of, L/K ratio for electron capture, 17: 28325
determination as impurity in phosphorus-32 by sorption in humus column, 17: 27284

IRON ISOTOPES Fe-56
alpha reactions (α,p) at 22 Mev, angular distributions from, 17: 28288
neutron activation rates for, fast, 17: 28221 (EUR-107.f)
nuclear radius, 17: 28334
x-ray emission from, pulse height spectra for 6-kev, 17: 27657 (UCRL-6886(Rev.1))

IRON ISOTOPES Fe-57
Mossbauer cross section for, 17: 28248 (TID-18899)

IRON ISOTOPES Fe-58
metabolism in infants and pregnant women, activation analysis, 17: 26985

IRON ISOTOPES Fe-59
determination as impurity in phosphorus-32 by sorption in humus column, 17: 27284
preparation by neutron reactions (n,p) with cobalt-59, 17: 28292

IRON OXIDES
Fe_2O_4–ZrO_2, characterization of hot-pressed, 17: 27728(R) (GEAP-4076)

IRON PHOSPHIDES
electron structure and physical properties of crystals of, 17: 27875

IRON SILICIDES
electron structure and physical properties of crystals of, 17: 27875

IRON SYSTEMS
Fe–Si, stress of, dislocation mobility in, 17: 27783(R) (GA-4227)
Fe–Si–U, phase studies, 17: 27858

IRON THIOCYANATES
radiolysis of acid solutions of, ion yield variations as function of concentration, 17: 27440

IRRADIATION FACILITIES
construction and operation of, for sterilization of medical supplies, 17: 27646
description and dose rates of 2-kC cobalt-60, 17: 27513
description of, at Harwell, 17: 28568
design of cryogenic, for low-temperature irradiations, 17: 28570(P)

IRRADIATION TECHNIQUES
opening of irradiated silica ampoules, 17: 27213

ISOTOPE EFFECTS
in intermolecular insertion, 17: 27411

ISOTOPE SEPARATION METHODS
electromagnetic, design and operation of zero deflection Colutron for, 17: 27714 (UCOL-P-516)
for boron, 17: 27715(T) (AEC-tr-5855)
variable key weight cascade, 17: 27712 (K-1571)

ISOTOPES
analysis of, theory and use of surface ionization mass spectrometric, 17: 27225 (AERE-R-4295)
equilibrium vapor pressure ratios of two, comparison of measurement results obtained by differential method and Rayleigh's method, 17: 28270
neutron resonance integrals of mixtures of, 17: 28219 (ANL-6709)
production by cosmic rays, geophysical applications of, 17: 28129
separation of, variable key weight cascade for multicomponent, 17: 27712 (K-1571)

ISOTRONS
design and operation of Colutron, 17: 27714 (UCOL-P-516)

ITALY
fallout monitoring in Lago Maggiore, 1958 through 1961, 17: 27588 (CNI-109)
ground water seasonal flow variation in Salentine Peninsula in, tracer studies of, 17: 27565 (RT/GEO(63)-25)
monitoring at Ispra, 1961, 17: 27591 (EUR-223.i)

J

JAPAN
radioactivity in sedimentary rocks in gas and oil fields in, 17: 27579
uranium market in, in 1962, 17: 26952

JET PROPULSION
developments in Project SQUID, 17: 27538(R) (NP-12767)

JOINTS
design for connecting headers to shell in tube-and-shell heat exchanger, 17: 27558(P)
design for mounting through thick walls, 17: 27522(P)
design of mechanical, for through-wall reactor control rod drive unit installation, 17: 28516(P)

K

KAOLINITES
thermal conductivity of powdered, 17: 27368

KEROSENE
kerosene–tributyl phosphate, separation from organic contaminants in ore refinery, 17: 27405 (NLCO-882)

KIDNEYS
radiation effects on enzyme activity, 17: 27066 (USNRDL-TR-640)
radiation effects on function of, in man, 17: 27077
uptake and retention of uranyl nitrate by rat, effects of chelating agents on, 17: 27025

KRYPTON
diffusion from single-crystal uranium carbide, 17: 27784 (GA-4267)
ion reactions in gases of, charge transfer and ionization cross sections for 60–450 kev rare-gas, 17: 28054
space charge neutralization in thermionic diodes by, 17: 27986
ultraviolet refractive indices of gaseous, Rayleigh scattering method for vacuum, 17: 28029
yields from thermal-neutron fission of uranium, 17: 27416 (HW-73394)

KRYPTON FLUORIDES
preparation, matrix isolation technique, 17: 27743

KRYPTON IONS
reactions in rare gases at 60–450 kev, charge transfer and ionization cross sections for, 17: 28054

KRYPTON ISOTOPES Kr-85
properties as universal tracer, 17: 27461
range and retention in metals at 1–150 kev, energy and flux dependence of,

17: 28002
use of, as tracer, developments in, 17: 27639(R) (TID-18881)

L

LABORATORIES
contamination prevention in radiobiology, 17: 27614
experiments in radiobiology for college and advanced high school students, manual for, 17: 27061 (TID-18616)
LABORATORY FURNITURE
description of large chamber for manipulating beta emitters, 17: 27512
design and performance of dust-controlled vented hood utilizing laminar air flow, 17: 27600 (SC-4905(RR))
design of rotatable chamber for radioactive materials, 17: 27526(P)
LACTIC ACID
production in x-irradiated tissue cells, 17: 27057 (MMPP-196-2)
LACTOSE
radiation effects on, electron spin resonance investigations of gamma, 17: 27454
LANTHANUM
partition coefficients and reciprocal ionic radii, 17: 27562 (INSJ-54)
LANTHANUM ALLOYS
La–Pu, phase studies, 17: 28565(R) (LAMS-2915)
LANTHANUM BROMIDES
spectra of neodymium and praseodymium ions in, covalency effects on shifts in, 17: 27311 (AROD-2099.12)
spectra of, vibronic satellites associated with electronic transitions in, 17: 27312 (AROD-2099.13)
LANTHANUM CHLORIDES
spectra of neodymium and praseodymium ions in, covalency effects on shifts in, 17: 27311 (AROD-2099.12)
spectra of, vibronic satellites associated with electronic transitions in, 17: 27312 (AROD-2099.13)
LANTHANUM ISOTOPES La-140
preparation, 17: 27640 (USNRDL-TR-638)
use as radiotracer in chemical explosions, 17: 27640 (USNRDL-TR-638)
LANTHANUM OXIDES
additive effects on thermal conductivity of uranium dioxide, 17: 27814(T) (EURAEC-103)
incorporation into uranium dioxide lattice, 17: 27487
spectra of, infrared absorption, 17: 27840
LARVAE
radiation effects on, of fruit flies, 17: 27120
LEAD
absorption, 17: 28139 (ISS-63/28(p.1-11))
beta emission by, determination of end-point energy, 17: 28183
bone deposition, tracer study, 17: 27016
determination as impurity in bismuth, spectrographic, 17: 27309
electron tunneling in aluminum oxide layer between superconducting in and, two-particle, 17: 28037
fission of, ternary argon-induced, 17: 28257 (UCRL-10772)
gamma reactions at 1–2 Mev, electron pair cross section Z-dependence from, 17: 28275
shielding effects on effects of unknown agent on erythrocyte sedimentation rate in human blood, 17: 27129
solvent properties for uranium, 17: 27394
spectra in reaction zone of acetylene air flame, excitation of atomic, 17: 27371(T)
x-ray spectra of, using promethium-147 beta source, 17: 27280
LEAD ALLOYS
Ba–Pb, crystal structure of BaPb, $BaPb_3$, and Ba_5Pb_3 in, 17: 27808 (UCRL-7030)
LEAD ISOTOPES Pb-205
neutron strength functions and widths for, 17: 28261
LEAD ISOTOPES Pb-206
content ratio to lead-207, thorium and uranium primordial abundance from, 17: 27575
LEAD ISOTOPES Pb-207
content ratio to lead-206, thorium and uranium primordial abundance from, 17: 27575
neutron strength functions and widths for, 17: 28261
LEAD ISOTOPES Pb-209
neutron strength functions and widths for, 17: 28261
LEAD ISOTOPES Pb-210
beta sorption from, as function of atomic number, 17: 28184
content in patients at Luchon, France, gamma spectra of, 17: 27042
determination in bone ashes, radiometric, 17: 27285
separation of daughters from, by paper electrophoresis in high electric fields, 17: 27445
LEAD ISOTOPES Pb-212
content in atmosphere over Mexico City, 17: 27628
determination in minerals, radiochemical, 17: 27252
LEAD OXIDES
incorporation into uranium dioxide lattice, 17: 27487
LEAD SULFATES
sorptive properties for phosphorus-32, effects of iron(III) on, 17: 27363
LEAD TITANATES
$PbTiO_3$–$PbZrO_3$, radiation effects on ferroelectric properties of, 17: 27894 (TID-18856)
LEAD ZIRCONATES
electronic dipoles and internal electric fields in, 17: 27393(T)
$PbTiO_3$–$PbZrO_3$, radiation effects on ferroelectric properties of, 17: 27894 (TID-18856)
LEAKS
detection in ionization chambers, 17: 27699
LEAVES
ignition of beech, pine, and walnut, by nuclear explosions, effects of burst heights and atmospheric conditions on, 17: 27945 (NP-12936)
LECTURES
on nuclear theory, 17: 28415
LEPTONS
decays and reactions of, 17: 28206
LEUCINE
radioinduced deamination in aqueous solution, 17: 27431
LEUKEMIA
in children, relation to prenatal radiation, 17: 27185
radiation effects on development of, therapeutic, 17: 27167
radiation effects on development of, in animals and man, 17: 27187
radiation effects on incidence of, in man, 17: 27210
radiotherapy of, using Mev-range x radiation, 17: 27000
LEUKOCYTES
phosphorus metabolism by, effects of staphylococcal leukocidin on, 17: 27028
LEVEL INDICATORS
design for liquid hydrogen, 17: 28085
LIGHT
emission from polygonal-cross section lasers, 17: 28063
energy from, storage device for, 17: 28104(P)
LIGHT SOURCES
operation of Kerr-cell-controlled, for production of short pulses, 17: 27671
LIGNIN
radiation effects on, in plants, 17: 27088
LIMONITE CONCRETES
shielding properties of, effects of barium and cadmium salts on, 17: 27930
LIQUID FLOW
magnetohydrodynamic boundary layer for, past semi-infinite plate against pressure gradient, 17: 27554
magnetohydrodynamic boundary layer for, past semi-infinite plate, 17: 27555
magnetohydrodynamic boundary layer for, past semi-infinite plate against pressure gradient, 17: 27556
LIQUID METAL COOLED REACTORS
design concepts of thorium-fueled, 17: 28457 (TID-7650(p.194-209))
design concepts of breeder, 17: 28458 (TID-7650(p.210-43))
problems of fast breeder, 17: 28544
LIQUIDS
boiling of cryogenic, peak heat flux and temperature difference in nucleate, 17: 28094
scattering by binary, 17: 28137 (BNL-6364)
theory of imperfect, 17: 28024
LITHIUM
corrosive effects on carbon steel, 17: 27755

effect on electron-induced defects in silicon, 17: 27927(T)
partition coefficients and reciprocal ionic radii, 17: 27562 (INSJ-54)
spectra in reaction zone of acetylene air flame, excitation of atomic, 17: 27371(T)
LITHIUM CHLORIDE CRYSTALS
spectra of, F-center positions in, 17: 27377
LITHIUM CHLORIDES
LiCl–KCl, solvent properties for thorium, 17: 28465 (TID-7650 (p.436-53))
LITHIUM FLUORIDE CRYSTALS
neutron scattering by, structure factors for cold, 17: 27392(T)
spectra of, F-center positions in, 17: 27377
spectra of, surface effects on optical transmission in vacuum-ultraviolet, 17: 27354
LITHIUM FLUORIDES
ductility of polycrystalline, 17: 27839
LITHIUM IONS
electron affinities of, relativistic and nonrelativistic, 17: 27996
yields in oxygen-16 reactions at 167 Mev, 17: 28252 (UCRL-10693)
LITHIUM ISOTOPES Li-7
deuteron reactions (d,p) on, polarizations from, 17: 28336
LITHIUM ISOTOPES Li-8
alpha spectra, 17: 28331
LITHIUM ISOTOPES Li-9
decay of, in meson (π^-) reactions with emulsion nuclei at 4.6 Bev/c, 17: 28274
LITHIUM NITRATES
polymerization effects on tetravalent plutonium in acid media, 17: 27319 (ORNL-TM-585)
LITHIUM OXIDES
additive effects on pulse height of quartz phosphors, 17: 27701
LITTER SIZES
characteristics, from 10 generations of irradiated sires, 17: 27101
radiation effects in rats, chronic, low-level gamma exposure, 17: 27170
LIVER
analysis for estrogen in, of broilers fed 3,4-dianisyl-2-t-3-hexene, use of tritium for, 17: 27050
chromosome aberrations in regenerating, effects of age and radiation exposure, 17: 27176
DNA content in, effects on radiosensitivity of rats, 17: 27141
metastasis prevention, by use of colloidal phosphorus-32-chromic phosphate, 17: 27126
phosphatase activity in, after injection of hematopoietic tissue in irradiated mice, 17: 27111
radiation effects on nucleoli in Chang cells of, 17: 27063 (TID-18846)
radiation effects on chromium-51 content of nucleic acids and proteins, 17: 27084
radiation effects on DNA synthesis in mouse and rat, 17: 27140
radioinduced nucleoprotein loss in cell nuclei of, in first four hours after x irradiation, 17: 27157
synthesis of ribonucleic acid in regenerating, tracer study, 17: 26970
thorium dioxide effects on development of hemangioendothelial sarcoma in, in man, 17: 27190
thorium dioxide effects on sarcoma development in, in man, 17: 27081
tumor metastasis in, after portal system injection of cells, 17: 26974
LIVERMORE POOL TYPE REACTOR
fuel plate temperature measurements in, maximum, 17: 28567 (UCRL-7214)
LOS ALAMOS MOLTEN PLUTONIUM REACTOR EXPERIMENTS
design of LAMPRE-1, 17: 27535 (BNL-801)
development and operation, quarterly summary, 17: 28565(R) (LAMS-2915)
fuel element analysis, 17: 27535 (BNL-801)
LOS ALAMOS SCIENTIFIC LAB., N. MEX.
publication list of, for 1957 to 1962, 17: 26946 (LAMS-2895)
LUBRICANTS
performance under simulated space conditions, 17: 27506 (NP-12906)
preparation of radiation-resistant mineral oils, 17: 27530(P)
LUMINESCENCE
bibliography on electro-, 17: 27946 (NP-12937)
mechanisms of field-induced, in powdered phosphors, 17: 27342
radioinduced in cell nuclear chemicals, 17: 27065 (UCRL-10724)
radioinduced in rare gases in an electric field, 17: 28011
ultraviolet radiation effects on, in *Armillaria mellea* cultures, 17: 27179
LUMINESCENT MATERIALS
radiation hazards from promethium-147-activated, 17: 27619
LUNGS
pneumonectomy and radiotherapy in case of broschial carcinoma, 17: 27007
sorption of albumin and whole protein from, tracer study, 17: 27041
LUTETIUM
partition coefficients and reciprocal ionic radii, 17: 27562 (INSJ-54)
LUTETIUM BORATES
crystal structure, 17: 27837
LUTETIUM OXIDES
entropy and heat content at 298 to 1800°K, 17: 27314 (BM-RI-6248)
spectra of, infrared absorption, 17: 27840
LYMPH SYSTEM
preservation of graft material, effects on immune reaction in irradiated recipient, 17: 26971
radioisotope distribution, of directly injected, 17: 26964(R) (ORINS-42)
LYSINES
radioinduced thermoluminescence in, 17: 27427
LYXOSE
radiation effects on, electron spin resonance investigations of gamma, 17: 27454

M

MACHINING
computer program for, 17: 27509 (TID-18844)
MAGNESIUM
book: *The Role of Magnesium in Biologic Processes*, 17: 27052
determination as impurity in bismuth, spectrographic, 17: 27309
determination in clams by activation, 17: 26963 (EUR-128.i)
exchange reactions with calcium, potassium, and sodium on ion exchange resin, equilibrium constant for, 17: 27038
metabolism in dogs, tracer study, 17: 27022
neutron elastic and inelastic scattering at 14 Mev, cross sections for, 17: 28276
partition coefficients and reciprocal ionic radii, 17: 27562 (INSJ-54)
reactions with hydrochloric acid, heat of, 17: 27323 (UCRL-7325-T)
separation from waste solutions by combined sodium carbonate-hydroxide precipitation and foam process, 17: 28584(R) (RAI-113)
solvent properties for thorium, 17: 28465 (TID-7650(p.436-53))
spectra in reaction zone of acetylene air flame, excitation of atomic, 17: 27371(T)
MAGNESIUM ALLOYS
Al–Mg, fatigue properties at 200 to 500°C, 17: 27847
Mg–Y, atomic number effects correction in electron probe microanalysis of, 17: 27268
Mg–Zr, fatigue properties at 200 to 500°C, 17: 27847
MAGNESIUM ALUMINATES
$MgAl_2O_4$–$NdAlO_3$, phase diagram, 17: 27335
MAGNESIUM CARBONATES
decomposition of basic, thermal, 17: 27313(R) (ASD-TDR-62-843)
MAGNESIUM CHLORIDES
$MgCl_2$–KCL–NaCl, rate processes in packed column during bismuth extraction from, 17: 27492 (BNL-791)
MAGNESIUM CRYSTALS
magnetic breakdown in, de Haas-van Alphen effect in, 17: 27870
MAGNESIUM IONS
electron affinities of, relativistic and nonrelativistic, 17: 27996
MAGNESIUM ISOTOPES Mg-24
alpha reactions (α,p) at 22 Mev, angular distributions from, 17: 28288
energy levels of, parity and spin for, 17: 28324
proton reactions (p,γ) at 1.49 Mev, aluminum-25 3.70-Mev level spin from, 17: 28266
MAGNESIUM ISOTOPES Mg-25
production in silicon-28 (n,α) reactions, fluctuations in excitation function for, 17: 28295
MAGNESIUM OXIDE POWDERS
thermal conductivity, 17: 27368
MAGNESIUM OXIDES

absorption of carbon dioxide at 300 to 900°C by, effects of calcination on, 17: 27313(R) (ASD-TDR-62-843)
additive effects on pulse height of quartz phosphors, 17: 27701
incorporation into uranium dioxide lattice, 17: 27487
oxygen exchange with water at 50 and 100°C, 17: 27313(R) (ASD-TDR-62-843)
preparation by thermal decomposition of basic carbonate, 17: 27313(R) (ASD-TDR-62-843)
radioinduced stresses in, from fission fragment bombardment, 17: 27888 (BMI-1635)
reactions with graphite, mechanism for, 17: 27344
BeO–MgO, phase studies, 17: 27833
BeO–MgO–ZrO_2, phase studies, 17: 27833
MgO–Ta_2O_5, phase studies, 17: 27834
MgO–ZrO_2, phase studies, 17: 27833

MAGNET COILS
protection of superconducting, during transition, 17: 27942 (NIRL/R/32)

MAGNETIC FIELDS
bibliography, 17: 27937 (AID-62-155)
effects of interplanetary, on solar wind interactions with geomagnetic field, 17: 27574
effects on current density in plasma, 17: 28397
flow in constant, momentum integral approximation for compressible magnetogasdynamic boundary-layer, 17: 28010
fluid velocity in parallel, instability of surface of discontinuity of, 17: 28013
hydromagnetic wave propagation in inhomogeneous, linear approximation for, 17: 27995
ideal polar surfaces required for weak or strong focusing in nuclear apparatus, 17: 28350
magnetohydrodynamic flow past semi-infinite plate in, boundary layer for two dimensional, 17: 27554
magnetohydrodynamic flow past semi-infinite plate in, boundary layer for two-dimensional, 17: 27555
magnetohydrodynamic flow past semi-infinite plate in, pressure gradient effects on two-dimensional, 17: 27556
particle trajectories in slowly varying, approximations for, 17: 28017
plasma equilibrium in, current-carrying toroidal, 17: 28392
plasma interactions with three-dimensional dipole, characteristics of, 17: 28381
plasma wave propagation in, dispersion curves for l-f, 17: 28375
production by superconductors, 17: 27936 (AERE-M-1207)
production of strong, technology and methods for, 17: 28006
Zeeman effect in alternating, 17: 28034(T)

MAGNETIC MATERIALS
neutron elastic scattering by complex, slow, 17: 28236(T)

MAGNETIC MIRROR MACHINES
bibliography, 17: 28361 (NP-12921)

MAGNETIC PROBES
bibliography, 17: 28361 (NP-12921)

MAGNETITE CONCRETES
shielding properties of, effects of barium and cadmium salts on, 17: 27930

MAGNETOHYDRODYNAMIC CELLS
characteristics, graphical method for study of, 17: 27997
design, 17: 28103(P)
design of nuclear, 17: 28551(P)
use with gas-cooled reactors, 17: 28548

MAGNETOHYDRODYNAMICS
bibliography, 17: 28361 (NP-12921)
book: *Magnetohydrodynamics*, 17: 28070
flow in, momentum integral approximation for compressible boundary-layer, 17: 28010
flow of conducting gas in presence of thin profiles, 17: 28371
flow of conducting liquid past semi-infinite plate, boundary layer for two-dimensional, 27555
flow of viscous liquid past semi-infinite plate against pressure gradient, boundary layer for two-dimensional, 17: 27554
flow of viscous liquid past semi-infinite plate against pressure gradient, boundary layer for two-dimensional, 17: 27556
flow of weakly dissipative fluids, 17: 28005
gas deflagration and detonation waves with ionization in electromagnetic field, 17: 28014
instability of a surface of discontinuity of velocity in a parallel uniform magnetic field, 17: 28013
motion of viscous incompressible weakly conductive fluid outside magnetized sphere, 17: 28368
of fluid flow in rectangular tube at high Hartmann number, 17: 28015
Rayleigh-Taylor problem of two superposed fluids in magnetic field, effects of electric conductivity on, 17: 28012
space propulsion system based on, research on, 17: 28362 (NP-12935)
wave propagation in partially ionized gases, 17: 27540(R) (NP-12767(p.65–7))
wave properties in relativistic anisotropic, 17: 28066

MAGNETOMETERS
design of magnetic resonance, for weak fields, 17: 27678(P)

MAGNETOSPHERE
boundary of outer, 17: 28123
electron and proton density in outer, at ≥ 40 kev, 17: 28123
electron density and geomagnetic field strength in remote, whistler measurements for, 17: 28020
geomagnetic storms in, solar-wind flux interpretations for, 17: 28116

MAGNETS
beam focusing by quadrupole, 17: 28357 (BNL-7120)
design and performance of high-field superconducting, 17: 28074
design for shielding, 17: 28410
design of Nimrod, apparatus and methods used in, 17: 28349 (NIRL/R/4)

MAGNOX ALLOYS
analysis of AL-80 and ZR-55, for iron, spectrophotometric, 17: 27236 (PG-Report-453)
analysis of AL-80, for aluminum, volumetric, 17: 27237 (PG-Report-454)
analysis of Magnox MN 70 for iron, spectrophotometric, 17: 27234 (PG-Report-437)
creep behavior of ZA, at 400 and 450°C in carbon dioxide and water, 17: 27849
creep ductility of ZA, effects of heat treatment in hydrogen at 500°C before working on, 17: 27848
grain growth and hydrogen pickup of Zr 55 at 475 and 600°C, effects of heat treatment atmosphere on, 17: 27846
recrystallization in, secondary, 17: 27845

MAINE
radioactivity from natural sources, 17: 27629

MALONONITRILE
protective effects of, against toxicity of 2,2'-dichloro-*N*-methyldiethylamine, 17: 27030

MALTOSE
radiation effects on, electron spin resonance investigations of gamma, 17: 27454

MAMMALS
radiation effects on late pathological, 17: 27146

MAN
by diagnosis and treatment of, with radioisotope deposition, 17: 27208
chest x rays of, modification of film size for, 17: 27610
radiation effects on, chronic internal, 17: 27150
radiation effects on, 17: 27151
radiation effects on erythrocytes in, 17: 27166
radiation effects on, cosmic, 17: 27196
radiation effects on incidence of leukemia in, 17: 27210
radiation effects on kidney function in, early, 17: 27077
radiation effects of space flight on, 17: 27115
radioinduced intestinal ileus in, from pelvic radiotherapy, 17: 27078
radioisotope contents in children, newborn infants, and stillborns, gamma, 17: 27013 (TID-18878)
strontium metabolism, tracer study, 17: 27049
thorium dioxide effects on sarcoma development in liver in, 17: 27081
tumor localization in, use of iodine-131-labeled compounds for, 17: 26992

MANGANESE
determination as impurity in bismuth, spectrographic, 17: 27309
determination in carbonatites, spectrographic, 17: 27228 (EUR-32.f)
determination in SAP, x-ray spectrographic, 17: 27226 (EUR-21.f)
ion exchange on resins, effects of boric acid and potassium hydroxide on, 17: 27493 (WCAP-3716)
spectra in reaction zone of acetylene air flame, excitation of atomic, 17: 27371(T)

use as tracer for activation analysis of cotton, 17: 27634(R) (NCSC-2477-4)

MANGANESE ALLOYS
Al–Be–Mn, determination of AlMnBe$_6$ in commercially pure beryllium, 17: 27856
Au–Mn, atomic number effects correction in electron probe microanalysis of, 17: 27268
Mn–U, phase transformation and grain refinement, 17: 27862

MANGANESE ISOTOPES Mn-54
content in vegetation in Northern Alaska from fallout, 17: 27053 (HW-SA-3050)
decay of, L/K ratio for electron capture, 17: 28325

MANGANESE ISOTOPES Mn-55
alpha reactions (α,p) at 22 Mev, angular distributions from, 17: 28288

MANGANESE SILICIDES
electron structure and physical properties of crystals of, 17: 27875

MANNOSE
radiation effects on, electron spin resonance investigations of gamma, 17: 27454

MANOMETERS
properties of Newtonian-oscillating, time-dependent, 17: 27654 (LADC-5535)

MARITIME PRESSURIZED WATER REACTOR
performance of N.S. *Savannah* Core II, 17: 28527 (GEAP-3828)

MARITIME REACTORS
design of pressure vessel and shielding arrangement for, 17: 28559(P)

MASERS (OPTICAL)
design of helium-neon, for plasma electron density measurements, 17: 28367
radiation from polygonal-cross section, 17: 28063

MASS SPECTROGRAPHY
isotopic analysis by surface ionization, internal standard technique for, 17: 27279
review of techniques for solids, 17: 27278
theory and use of surface ionization, 17: 27225 (AERE-R-4295)

MASS TRANSFER
measurement of, equipment for, 17: 27967

MATERIALS TESTING
development of nondestructive methods for, 17: 27560 (WAPD-T-1530)
device for producing acceleration pulses for, 17: 27947 (TID-18816)

MATHEMATICS
asymptotic behavior of Green functions, 17: 28178
Bethe-Goldstone equation solution for two-nucleon potential with hard core, 17: 28330
book: *Elements of Numerical Analysis and Mathematical Processing of Experimental Results*, 17: 27726
implicit finite difference schemes for hyperbolic systems, 17: 27722 (NYO-10426)

MATTER
book: *Passage of Charged Particles Through Matter*, 17: 28071

MEDICINE
book: *Medical Aspects of Radiation Accidents*, 17: 27632
control of radiation in Massachusetts industry by, 17: 27615
hospital organization for times of disaster and warfare, 17: 27623
radiation effects on blood of personnel in, data on, 17: 27620
radioisotope uses in, review, 17: 27005
radiology in, developments in, 17: 27626

MEMORY DEVICES
PEM, for precision-photographing of data, 17: 26949 (TID-18887)

MERCURY
behavior in waste solutions, 17: 28581(R) (HW-77299)
heat transfer research on, 17: 27535 (BNL-801)
spectra in reaction zone of acetylene air flame, excitation of atomic, 17: 27371(T)

MERCURY ALLOYS
Hg–Zn, electro- and radiochemical studies of electrode reactions of, 17: 27398

MERCURY ISOTOPES Hg-193
spectra of isomeric, hyperfine structure and isomer shifts from, 17: 28285

MERCURY ISOTOPES Hg-194
spectra of, hyperfine structure, isotope shift, and nuclear moments from, 17: 28284
spectra of, hyperfine structure and isotope shifts from, 17: 28285

MERCURY ISOTOPES Hg-195
spectra of ground-state and isomeric, hyperfine structure, isotope shift, and nuclear moments from, 17: 28284
spectra of ground-state and isomeric, hyperfine structure, isomer and isotope shifts from, 17: 28285

MERCURY SYSTEMS
Hg–N, flow characteristics for two-phase, 17: 27535 (BNL-801)

MESONS
interactions with nucleons, algebraic equations for describing, 17: 28142 (JINR-E-1262)

MESONS (K)
decay of, branching ratio for gamma and meson (π), 17: 28190
interaction resonance state ($\bar{K}$-N) coupling to (Σ-π), 17: 28136 (BNL-6363)
interactions with hyperons (Σ), mesons (K) and (π), and nucleons, 17: 28172

MESONS (K^-)
interactions with protons at 1.51 Bev/c, meson (ω) decay and production in, 17: 28159 (UCRL-10723)
reactions with deuterium, cross sections for charge-exchange, disintegration and elastic, 17: 28263
reactions with nuclei at 800 Mev/c, hyperon (Λ) beta decay branching ratio from, 17: 28192

MESONS (K^0)
decay of, method for testing time-invariance by, 17: 28414

MESONS ($K^+_{\mu 3}$)
decay, 17: 28211

MESONS (μ)
reactions on nuclei, mesons (π) from, 17: 28341

MESONS (μ^-)
capture in atomic K shells, angular correlations from, 17: 28215

MESONS (μ^+)
incorporation into organic molecules and radicals, 17: 28342

MESONS (ϕ)
properties, 17: 28154 (NYO-10264)

MESONS (π)
interactions at low energies, partial-wave dispersion relations for, 17: 28191
interactions of, mesons (π) and (ρ) production cross sections from, 17: 28189
interactions of, Regge pole parameters determination from, 17: 28167
interactions with hyperons (Σ), production of resonance-state, 17: 28136 (BNL-6363)
interactions with hyperons (Σ) and mesons (K) and (π), resonance, 17: 28172
interactions with mesons (π) and nucleons, amplitudes for, 17: 28212
interactions with nucleons, asymptotic relations for cross sections of, 17: 28218
photoproduction of, asymptotic relations for cross sections of, 17: 28218
production in meson (π) interactions, cross sections for, 17: 28189
production in meson (μ) reactions on nuclei, 17: 28341
production in proton (p-p) interactions at 660 Mev, 17: 28140 (JINR-D-1236)
production in proton inelastic scattering by complex nuclei at 27 Bev, angular distributions for, 17: 28304
scattering of, on mesons (π), effect on nucleon form factor of inelastic, 17: 28198
wave functions for four-body system of, orthonormal, 17: 28162
wave functions for many-body systems of, isotopic spin symmetry in, 17: 28165

MESONS (π^-)
absorption by copper, lead, and tin, 17: 28139 (ISS-63/28(p.1-11))
decay ($e^- + \nu$) and ($\mu^- + \nu$), effects of e and μ spirality on probabilities of, 17: 28173
decay of accelerated, interactions of neutrinos from, 17: 28151 (NEVIS-111)
interactions of, with carbon at 915 Mev, Monte Carlo calculation of, 17: 28199
interactions with protons, cross section and momentum spectrum of hyperons (Λ) produced in, 17: 28144 (JINR-P-1245)

interactions with protons under 800 Mev, cross sections, Dalitz plots, and mass spectra for, 17: 28158 (UCRL-10720)
interactions with protons at 7 Bev, inelastic two-prong, 17: 28171
interactions with deuterons at 300 Mev, cross section for elastic, 17: 28185
interactions with protons at 6.8 Bev/c, inelastic, 17: 28205
interactions with nucleons at 7 Bev, peripheral, 17: 28208
reactions on xenon nuclei, strange particles from, 17: 28339
reactions with emulsion nuclei at 4.6 Bev/c, lithium-9 decay in, 17: 28274

MESONS (π^0)
photoproduction on protons at 181 Mev, 17: 28204

MESONS (π^+)
decay ($e^+ + \nu$) and ($\mu^+ + \nu$), e and μ spirality effects on probabilities of, 17: 28173
decay of accelerated, interactions of neutrinos from, 17: 28151 (NEVIS-111)
interactions with protons at 600 Mev, branching ratios and cross sections for, 17: 28156 (UCRL-10563)
interactions with deuterons at 300 Mev, cross section for elastic, 17: 28185

MESONS (ρ)
production in meson (π) interactions, cross sections for, 17: 28189
trajectory of, calculation, 17: 28145 (JINR-P-1246)

MESONS (ζ)
spin, 17: 28153 (NP-12904)

METABOLISM
book: *Ionizing Radiation and Metabolism*, 17: 27192
effects of, on radiosensitivity of animals, 17: 27047
radiation effects on cellular, 17: 27108
radiation effects on, effects of dose rate in rats, 17: 27143

METALLURGY
dislocation theory in engineering, 17: 27810 (UCRL-10788)
mechanical properties of two-phase dispersion-strengthened crystalline materials, 17: 27882
research programs on rolling, 17: 27759 (MAB-139-M(R3))

METALS
analysis of liquid, for oxygen, 17: 27731 (NASA-TM-X-884)
deformation energy measurement in, liquid-gas calorimeter for, 17: 27663
determination in ores, beta radiation method for, 17: 27283
dislocations in strained f.c.c., experimental verification of theories of, 17: 27842
electric conductivity, effects of vacancy-impurity pairs on, 17: 27776 (BNL-6358)
fabrication by rolling, research programs on, 17: 27759 (MAB-139-M(R3))
heat transfer by, research on, 17: 27535 (BNL-801)
metallography of, thermal cycling effects on, 17: 27755
physical chemistry, 17: 27755
production from halides, 17: 27220(P)
production of heavy, by chlorination of oxides, 17: 27490
radiation effects at 4.2°K, design of cryostat for electron, 17: 28091
research programs on liquid, in France and Great Britain, 17: 27731 (NASA-TM-X-884)
separation from aqueous solutions by solvent extraction using dibutyl phosphorothioic acid, 17: 27408
technology of high-temperature liquid, review, 17: 27535 (BNL-801)
tensile properties of body-centered-cubic, theory of, 17: 27730(R) (HW-77052)
thermionic cell collectors of liquid, analysis of, 17: 27987

METHACRYLAMIDE
aryl-, radioinduced polymerization in solid state, 17: 27448
radioinduced polymerization in solid state, 17: 27448

METHACRYLIC ACID, METHYL ESTER
radioinduced graft polymerization on wool, 17: 27900

METHACRYLIC ACID, METHYL ESTER POLYMERS
radioinduced free radicals in, reactions with diphenylpicrylhydrazyl, 17: 27215
radioinduced graft polymerization of vinyl pyrrolidone on, 17: 26944(R) (BMI-1630(Del.))
radioinduced graft polymerization of vinyl acetate on, 17: 27449
radiolysis of copolymer with polystyrene, formation of peroxides in, 17: 27475
radiolysis of, effects of dose and oxygen on peroxide formation in, 17: 27475

METHANE
electron wave function for molecules of, one-center, 17: 27366
heat of formation, 17: 27322 (UCRL-7301-T)
radiolysis of, formation of products of, in reactor, 17: 27479

METHANE, CHLORO-
energy level density of, vibrational, 17: 27367

METHANE, DICHLORO-
analytical use for photometric determination of boron in uranium tetrafluoride, 17: 27307

METHANE, IODO-
radiation reactions with, iodine-128 extraction yield from gamma and neutron, 17: 27456

METHANOL
analysis of, for water using krypton-85, 17: 27639(R) (TID-18881)
formation by radiolysis of propenediol in air and nitrogen, 17: 27424

METHIONINE
radioinduced thermoluminescence in, 17: 27427
sulfoximine, effect on urinary excretion of phosphorus and desoxyribose in rats, 17: 27037

METHYL RADICALS
scavenging of deuterated, by nitric oxide at low temperature, 17: 27337

METHYL RED
color change induced in, by unknown x-agent, 17: 27452

METHYLENE
insertion in irradiated propane, phase dependence of carbon-11 recoil products for, 17: 27415 (BNL-6354)

MEXICO
radiological monitoring of atmosphere over Mexico City for lead-212 as a measure of radioactive contamination, 17: 27628

MICA
radiation effects on photoconductivity of reconstituted, 17: 27893 (TID-18843)

MICE
fate of tumor cells injected into portal system, 17: 26974
radiation effects on tritium content in organs and skin of, 17: 27181
radiation effects on bone marrow and spleen in, cosmic, 17: 27198
radiation effects on, genetic, 17: 27098
radiation effects on breeding characteristics, long-term, 17: 27101
radiation effects on development of transplanted oocytes, 17: 27117
radiation effects on course of influenza virus infections in, 17: 27123
radiation effects on, continuous, 17: 27148
radiation sickness in, protective effects of Librium against, 17: 27189
radioinduced hair dysplasia, protective effects of cysteamine, 17: 27174
radiosensitivity, effects of thyroid function, 17: 27173
radiosensitivity of pure albino, 17: 27182
radiosensitivity of mammary tumor cells in, effects of membrane system and mitochondria on, 17: 27135
radiosensitivity of rapidly dividing cells in, 17: 27138
radiosensitivity of cells in, molecular nature of, 17: 27140

MICROORGANISMS
changes in intestinal, in irradiated rats, 17: 27074
radiation effects on filament formation in, 17: 27136

MICROWAVE EQUIPMENT
design of cavity for fast wave plasma cyclotron amplifier, 17: 27650(R) (AD-297382)
klystron sweeping arrangement, 17: 27650(R) (AD-297382)

MICROWAVES
effects on superconducting tin, switching speed and nonlinear, 17: 28045

MILK
acidophilus, protective effects against radiation injury in guinea pigs, 17: 27082
acidophilus, protective effects against radiation injury in guinea pigs, 17: 27083
analysis for strontium-90, samples collected in 1962, 17: 27592(R) (HASL-138)
cesium-137, iodine-131, and strontium-90 levels in, in Italy, 1961, 17: 27591 (EUR-223.i)
decontamination of strontium-90 from, 17: 27606
separation of strontium-90 from, method for, 17: 27038

strontium removal from, ion exchange, 17: 27223(P)
MINERALS
analysis for alkali metals, method for, 17: 27243(T) (AEC-tr-5822)
analysis for polonium-210 and lead-212, radiochemical, 17: 27252
radiation effects on color of pearl, 17: 27901
MINING
industrial hygiene in rare metal ore mines, 17: 27603(T) (JPRS-19866)
radiation hazards in uranium, 17: 27617
uses of atomic and chemical explosions in excavations, 17: 27504 (EUR-7.f)
MISSILES
power supply for, design of simplified radioactive, 17: 28578(P)
MITOCHONDRIA
effects on radiosensitivity of mammary tumor cells in mice, 17: 27135
radiosensitivity of enzyme systems in thymus, 17: 27086
MITOSIS
radiation effects, 17: 27108
radiosensitivity of cells in various phases, 17: 27152
radiosensitivity of chromosomes in different phases, 17: 27168
radiosensitivity of 4 stages in, 17: 27138
MIXER-SETTLERS
design and performance for extraction experiments, 17: 27501
MOLECULAR BEAMS
production of high-intensity, three-fluid model for analysis of skimmer for, 17: 28042
MOLECULAR STRUCTURE
bond length measurement by electron diffraction, 17: 27358
MOLECULES
bond length measurement by electron diffraction, 17: 27358
electron energies in diatomic, automatic computation of, 17: 27360
formation and observation of μ^+ mesic organic, 17: 28342
isotope effect in organic, 17: 27411
radiation damage to, partial, 17: 27114
reaction kinetics and mechanisms at high temperatures, 17: 27538(R) (NP-12767)
spectra of, isotopic shifts in, 17: 27396
MOLLUSKS
analysis of magnesium content, activation, 17: 26963 (EUR-128.i)
MOLYBDENITES
age of, rhenium method for determining, 17: 27566(T) (AEC-tr-5858)
MOLYBDENUM
brazing, exothermic, 17: 27760(R) (NP-12901)
catalytic effects on hydrocracking of polyphenyls, 17: 28434 (IDO-16858)
chemical regeneration of, in thermionic cells, 17: 27968
compatibility with uranium dioxide at 1800 and 1900°C, 17: 26944(R) (BMI-1630(Del.))
deformation, thermally activated, 17: 27879
determination in fissium–uranium alloys, fluorescent x-ray spectrometric, 17: 27255
determination in stainless steel microspheres, activation, 17: 27253
evaporation in cesium-filled thermionic cells, 17: 27967
hardness and recrystallization at high temperatures, 17: 27760(R) (NP-12901)
ion transfer from emitter to collector in thermionic diodes, 17: 27964
neutron cross sections for, fast, 17: 28245 (KFK-120)
photon reactions with, proton angular distributions and yields at >8 Mev, 17: 28265
radiation effects on, hardening in stage III recovery from neutron, 17: 27922
radiation effects on properties and structure of, 17: 27730(R) (HW-77052)
reactions with uranium-bearing reactor fuels, 17: 27961
separation from thorium using liquid-metal extraction, 17: 28465 (TID-7650(p.436-53))
separation from tungsten, methods for, 17: 27401
separation of, radiochemical, 17: 27264
spectra in reaction zone of acetylene air flame, excitation of atomic, 17: 27371(T)
thermodynamic properties of, bibliography on, 17: 27793 (NP-12938)
work function, 17: 27970
work function of, reduction of, 17: 27972
MOLYBDENUM ALLOYS
phase diagrams of binary and ternary, 17: 27778 (DMIC-183)
Co–Mo, structure of sigma phase Co_2Mo_3, 17: 27818
Co–Mo–Pt, catalytic effects on hydrocracking of polyphenyls, 17: 28434 (IDO-16858)
Cr–Fe–Mo–Ni, stress-corrosion cracking by boiler water at 500°F and sea water at 550°F, 17: 27749 (KAPL-M-CC-3)
Mo–Nb–Ta–W, tensile properties, 17: 27812(R) (WADD-TR-61-134(Pt.II))
Mo–Nb–W–Zr, tensile properties, 17: 27878
Mo–Ti, tensile properties, 17: 27878
Mo–Ti–Zr, brazing of TZM, exothermic, 17: 27760(R) (NP-12901)
Mo–Ti–Zr, hardness and recrystallization of TZM, at high temperatures, 17: 27760(R) (NP-12901)
Mo–U, evidence of late grain boundaries in, 17: 27855
Mo–U, metallography, 17: 27790 (NAA-SR-Memo-8408)
Mo–U, reactions with hydrogen halides, 17: 27403(P)
MOLYBDENUM CARBIDES
bibliography on properties, 17: 27809 (UCRL-7284)
MOLYBDENUM COMPACTS
density, 17: 27829
MOLYBDENUM ISOTOPES Mo-99
diffusion in, self-, 17: 27868
MOLYBDENUM NITRIDES
electron structure and physical properties of crystals of, 17: 27875
sintering of, electron density in phase lattices and optimal conditions for, 17: 27767
MOLYBDENUM OXIDES
catalytic effects on hydrocracking of polyphenyls, 17: 28434 (IDO-16858)
MOLYBDENUM SILICIDES
electron structure and physical properties of crystals of, 17: 27875
MOLYBDENUM STEEL
Cr–Mo–U, effects of cerium on impurities, mechanical properties, and oxidation of, 17: 27859
MOLYBDENUM SYSTEMS
Cs–CsF–Mo, properties as thermionic emitter, 17: 27973
Mo–UC, properties as thermionic cell emitters, 17: 27962
Mo–UO_2, electric conductivity, 17: 26944(R) (BMI-1630(Del.))
Mo–UO_2, thermal conductivity, 17: 26944(R) (BMI-1630(Del.))
Mo–U–UC, fabrication as fuel material for Fermi Fast Breeder Reactor, process developments for, 17: 28531 (ORNL-3437)
Mo–U–UO_2, fabrication as fuel material for Fermi Fast Breeder Reactor, process developments for, 17: 28531 (ORNL-3437)
MONEL
corrosion by boiling niobium pentafluoride, 17: 26944(R) (BMI-1630 (Del.))
MONKEYS
calcium-45 uptake by bones and teeth in, 17: 27039
MONTMORILLONITES
ion exchange properties of calcined, for radioactive ions, 17: 27218
MÖSSBAUER EFFECT
equipment for, design of high-velocity drive for, 17: 27665
spectra in simple cubic crystals, detection of localized mode vibrational, 17: 27375
theory of, on impurity nuclei in solids, 17: 28340
MULTIPLICATION FACTOR
calculation for one-dimensional multiregion reactors, 17: 28495
reactivity measurement in highly subcritical range by digital cross-correlation technique, 17: 28444 (NP-12910)
variation of long-term reactivity for different types of fuel cycles, 17: 28426 (EUR-129.f)
MUONIUM
discovery, preparation, and properties, 17: 28163
reactions with organic molecules, μ^+ mesic molecules from, 17: 28342
MUSCLES
analysis for estrogen in, of broilers fed 3,4-dianisyl-2-e-3-hexene, use of tritium for, 17: 27050
MUTATIONS
in *Aspergillus fumigatus*, 17: 26978
in Drosophila populations, 17: 26977
in *Escherichia coli*, galactose, 17: 26980
induction by x radiation or nitrogen mustard in Drosophila, 17: 27099
of *Paramecium aurelia*, 17: 26979

plant, genetic structure demonstrated after x irradiation, 17: 27100
radioinduced in Drosophila, effect of maternal nutrition, 17: 27102
radioinduced in mice, search for sex-linked lethals, 17: 27098

N

NAPHTHALENES
fluorescence of solution scintillators containing, characteristics of, 17: 27451
NATURAL WATERS
analysis for liquid-solid ratio in, using radiation attenuation gage, 17: 27564(R) (NYO-10219)
NEODYMIUM
partition coefficients and reciprocal ionic radii, 17: 27562 (INSJ-54)
NEODYMIUM ALLOYS
Nd–Pu, phase studies, 17: 28565(R) (LAMS-2915)
NEODYMIUM ALUMINATES
$MgAl_2O_4$–$NdAlO_3$, phase diagram, 17: 27335
NEODYMIUM BORIDES
electron structure and physical properties of crystals of, 17: 27875
NEODYMIUM IONS
spectra of, in lanthanum bromide and chloride crystals, covalency effects on shifts in, 17: 27311 (AROD-2099.12)
NEODYMIUM OXIDES
spectra of, infrared absorption, 17: 27840
NEON
ion reactions in gases of, charge transfer and ionization cross sections for 60–450 kev rare-gas, 17: 28054
ionization by fission fragments in nuclear thermionic cells, 17: 27985
NEON IONS
electron affinities of, relativistic and nonrelativistic, 17: 27996
reactions in rare gases at 60–450 kev, charge transfer and ionization cross sections for, 17: 28054
NEON ISOTOPES Ne-19
energy levels, 17: 28298
NEON ISOTOPES Ne-20
reactions with nuclei, collision effects in, 17: 28258 (UCRL-10775)
reactions with uranium-238, half life of spontaneously fissionable isomer from, 17: 28241 (JINR-P-1258)
NEON ISOTOPES Ne-22
reactions with uranium-238, half life of spontaneously fissionable isomer from, 17: 28241 (JINR-P-1258)
NEON SYSTEMS
He–Ne, plasma electron density measurements with lasers of, 17: 28367
NEPHROSIS
occurrence of acute, from x-ray therapy of lymphosarcomas, 17: 27203
NEPTUNIUM COMPLEXES
formation in aqueous solutions by ion exchange, 17: 27350
separation of pentavalent chelates by extraction, 17: 27350
NEPTUNIUM(V) IONS
chemistry, 17: 27350
NEPTUNIUM ISOTOPES Np-237
energy levels, 17: 28297
NEPTUNIUM ISOTOPES Np-239
separation from uranium and fission products by solvent extraction from nitric acid, 17: 27446
NEPTUNIUM OXIDES
properties of pentavalent, comparison to americium, plutonium, and uranium, 17: 27350
NERVOUS SYSTEM
book: *Irradiation and the Nervous System*, 17: 27194
book: *Problems of Ionizing Radiation Effects on the Nervous System*, 17: 27193
radiation effects, 17: 27069(T) (JPRS-19284)
radiosensitivity of developing, 17: 27169
NEUTRINOS
existence of two, proof of, 17: 28152 (NEVIS-113)
interactions and production of, cross sections for, 17: 28151 (NEVIS-111)
NEUTRON-ABSORPTION ANALYSIS
use for analysis of coal, 17: 27240(R) (TID-18883)
NEUTRON BEAMS
scattering from cylindrical targets, computer program for analyzing, 17: 28223 (NAA-SR-Memo-8427)
NEUTRON CROSS SECTIONS
calculation of thermal, SWAK program for, 17: 28243 (KAPL-M-RPC-6)
tables of, for fast reactor materials, 17: 28245 (KFK-120)
NEUTRON DIFFRACTOMETERS
design of, engineering drawings for, 17: 27674
NEUTRON RESONANCE CROSS SECTIONS
Doppler broadening, calculation, 17: 28307
NEUTRON SHIELDING
neutron diffusion in, computer program for calculating, 17: 28220 (EUR-106.f)
research program at HAPO on, review of, 17: 28408 (HW-SA-3032)
NEUTRON SOURCES
calibration of thermal, 17: 28232
development of, for short-time pulses, 17: 28329
NEUTRON SPECTRA
calculation of thermal, SWAK program for, 17: 28243 (KAPL-M-RPC-6)
NEUTRONS
absorption by isotopic mixtures, resonance integrals for, 17: 28219 (ANL-6709)
beta decay of, method for testing time-invariance by, 17: 28414
blackness coefficients for plane slabs, 17: 28437 (KAPL-2000-20)
capture by heavy nuclei, statistical analysis of energy levels for, 17: 28282
capture of, computer program for calculating resonance integrals for, 17: 28238 (AEEW-M-304)
detection of, reactions for resonance and threshold, 17: 28237 (AE-102)
detection of, survey instrument for, 17: 27685 (LA-2860)
diffusion calculations in control elements, linear extrapolation distance for, 17: 28235
diffusion constants for, computer program for calculating, 17: 28220 (EUR-106.f)
diffusion equations for, computer program for solving, 17: 28228 (WAPD-T-1589)
diffusion equations for, flux linear relation to adjoint functions in two-group, 17: 28233
diffusion in cylindrical flux trap assembly, solution of group equations for, 17: 28031
diffusion in hollow slowing-down control rods, calculation of boundary conditions for, 17: 28491
diffusion in thermal reactors, modified two-group theory model for, 17: 28231
diffusion of, TRAM code for calculating, 17: 28222 (KAPL-M-RPC-1(Rev.1))
distributions in reactors, methods of calculating and measuring, 17: 28492
flux measurement using foils, corrections for perturbations in, 17: 28234
flux measurements in critical assemblies, techniques for, 17: 28439 (KAPL-M-JNB-1)
interactions with deuterons, doublet scattering lengths for, 17: 28210
penetration in hydrogen slabs at 8.1 Mev, Monte Carlo calculations, 17: 28411
photoproduction of, analysis of reactions for, 17: 28246 (NDA-Memo-2123-1)
production in oxygen-16 reactions with gold, 17: 28251 (UCRL-10689)
production in photon reactions (γ,n) with sulfur-32 at 22 Mev, cross sections for, 17: 28286
reactions (n,α) with silicon-28, intensity fluctuations of excitation function for, 17: 28295
reactions other than (n,γ), activation analysis with, 17: 27230 (IA-839)
reactions with uranium, antimony-127 and 129 fission yields in, 17: 28278
reactions with uranium, palladium-111 and 111m cumulative yields in fission, 17: 28280
reflection from semi-infinite slab, angular distribution and reflection coefficient for, 17: 28437 (KAPL-2000-20)
resonance integrals for uranium-238 in hydrogen mixtures, effects of temperature, 17: 28306
scattering by carbon-12 at 14 Mev, differential and excitation cross sections for, 17: 28301
scattering by crystals, method for calculating, 17: 28226 (UCRL-7267)
scattering by liquid-like binary, description of, 17: 28137 (BNL-6364)

slowing-down spectrum in water, 17: 28437 (KAPL-2000-20)
spectra in reactor matrices, 17: 28437 (KAPL-2000-20)
strength functions and widths for lead and tin isotopes, 17: 28261
thermal utilization factor for, determination from fuel-element extrapolation lengths, 17: 28230
transport equations for, existence and uniqueness theorems for, 17: 28225 (TID-18885)
transport equation in finite slab, method for solving one-dimensional, 17: 28227 (WAPD-T-1392)
transport in slab geometry, solution of time-dependent, 17: 28224(R) (TID-18884)
transport theory for, energy-dependent, 17: 28229
yield in (d,n) reactions with deuterium and tritium, total, 17: 28254 (UCRL-10752(Suppl.))

NEUTRONS, COLD
scattering by sodium chloride-type crystals, structure factors for, 17: 27392(T)

NEUTRONS, FAST
attenuation by water, 17: 28221 (EUR-107.f)
capture by thorium-232 at 0.19–1.1 Mev, cross sections for, 17: 28279
detectors of, activation rates for threshold, 17: 28221 (EUR-107.f)
dosimetry using nuclear emulsions, methodological errors in, 17: 27692
reactions with chlorine, phosphorus, silicon, and sulfur at 3–5 Mev, total cross sections for, 17: 28287
reactions with nuclei, angular distributions for, 17: 28240 (BNL-400(Vols.I and II))
scattering by magnesium at 14 Mev, cross sections for elastic and inelastic, 17: 28275

NEUTRONS, FISSION
reactions (n,p) with cobalt-59, cross sections for, 17: 28292

NEUTRONS, THERMAL
capture by samarium-149, conversion electron and gamma spectra for, 17: 28305
diffusion and scattering in cold polyethylene, 17: 28437 (KAPL-2000-20)
diffusion lengths in polyethylene and water, 17: 28437 (KAPL-2000-20)
diffusion of, SWAK program for calculating, 17: 28243 (KAPL-M-RPC-6)
distributions in hydrogen-moderated, fuel-bearing assemblies, 17: 28437 (KAPL-2000-20)
flux of, calibration of National Bureau of Standards, 17: 28232
reactions (n,α) with chromium-53, chromium-54 energy levels and spins from, 17: 28320
reactions (n,γ) with cadmium-114, europium-154, and holmium-166, gamma spectra from , 17: 28332
reactions with plutonium-239, capture-to-fission ratio for, 17: 28277
scattering by complex magnetic crystalline structures, elastic, 17: 28236(T)

NEVADA PROVING GROUNDS AREA
monitoring for beta activities in rabbits and rabbits after reactor test (Kiwi-A), 17: 27054 (TID-18864)

NEW HAMPSHIRE
radioactivity from natural sources, 17: 27629

NEW YORK
radiation control regulations, 17: 27597 (NP-12924)

NICHROME
oxidation of types V and V-Cb, by air and nitrogen–oxygen at 1750 and 1850°F, 17: 28528(R) (IDO-28607)

NICKEL
catalytic effects on deuterium exchange between benzene and heavy water, 17: 27384
catalytic effects on isotope exchange between ammonia and deuterium, 17: 27386
catalytic effects on isotope exchange between anisole or xylene and deuterium oxide, 17: 27387
catalytic effects on isotope exchange between deuterium and toluene, 17: 27389
catalytic effects on isotope exchange between deuterium oxide and propene, 17: 27390
corrosion by boiling niobium pentafluoride, 17: 26944(R) (BMI-1630 (Del.))
determination as impurity in bismuth, spectrographic, 17: 27309
determination in polyphenyls, x-ray spectrographic, 17: 27227 (EUR-28.f)
determination in SAP, x-ray spectrographic, 17: 27226 (EUR-21.f)
diffusion in cobalt and cobalt–nickel alloys, magnetic effect on, 17: 27841
distribution in Zircaloy-2 and zirconium oxide, use of electron microprobe for determination of, 17: 27746(R) (DPST-63-71-1)
neutron cross sections for, fast, 17: 28245 (KFK-120)
oxidation of thoria-dispersion-hardened, 17: 27730(R) (HW-77052)
oxygen-16 reactions at 167 Mev, charged-particle yields in, 17: 28252 (UCRL-10693)
photon reactions (y,d) and (y,p) at 24 Mev, yield ratios for, 17: 28289
photon reactions with, proton angular distributions and yields at >8 Mev, 17: 28265
properties of, dispersion velocity dependence on mechanical and thermal, 17: 27873
separation from cobalt, methods for, 17: 27401
spectra in reaction zone of acetylene air flame, excitation of atomic, 17: 27371(T)
thermal conductivity, 17: 27789(R) (MLM-1156)
work function of, reduction of, 17: 27972
xenon-133 ranges and retention at 1–150 kev, energy and flux dependence of, 17: 28002

NICKEL ALLOYS
radiation effects on mechanical properties of, 17: 27730(R) (HW-77052)
Al–Fe–Ni, corrosion by water at 330°C, 17: 27730(R) (HW-77052)
Al–Ni–Nb, crystal structure of intermetallic compounds, 17: 27828
Al–Ni–Nb, reactions between Ni_2Al and Ni_2Nb in, 17: 27827
Al–Ni–Pu, fabrication by pneumatic injection casting, 17: 27758 (HW-69204)
Ba–Ni, performance of thermionic cell with cathode of, 17: 27981
Ce–Ni–Pu, properties of, 17: 27789(R) (MLM-1156)
Co–Ni, diffusion in, magnetic effect on, 17: 27841
Cr–Fe–Mo–Ni, stress-corrosion cracking by boiler water at 500°F and sea water at 550°F, 17: 27749 (KAPL-M-CC-3)
Cr–Fe–Ni, stress-corrosion cracking by boiler water at 500°F and sea water at 550°F, 17: 27749 (KAPL-M-CC-3)
Cr–Ni–Nb, phase diagram, 17: 27825
Ni–Zr, hydrogen overvoltage measurements in, 17: 27728(R) (GEAP-4076)

NICKEL CATALYSTS
radiation effects on activity and sorptive properties of, gamma and neutron, 17: 27483

NICKEL FILMS
argon reactions at 100 ev, dislocation dipoles and loops from, 17: 27920

NICKEL ISOTOPES
deuteron reactions (d,n) on, distributions from, 17: 28335

NICKEL ISOTOPES Ni-58
deuteron reactions (d,α), (d,αn), (d,αp), (d,2np), and (d,2pn) at 0–24 Mev, excitation functions and inverse cross sections for, 17: 28317
neutron activation rates for, fast, 17: 28221 (EUR-107.f)
neutron reactions (n,p) with, properties as neutron threshold detectors, 17: 28237 (AE-102)

NICKEL ISOTOPES Ni-59
decay of, inner bremsstrahlung transitions and interference of K-capture gamma transitions in, 17: 28322

NICKEL ISOTOPES Ni-60
deuteron reactions (d,2n) at 0–24 Mev, excitation functions and inverse cross sections for, 17: 28317

NICKEL ISOTOPES Ni-64
proton reactions (p,n) with, excitation function and recoil behavior for, 17: 28247(R) (TID-18788)

NICKEL OXIDES
catalytic effects on hydrocracking of polyphenyls, 17: 28434 (IDO-16858)
incorporation into uranium dioxide lattice, 17: 27487
Al_2O_3–NiO_2, catalytic effects on hydrocracking of high boilers in reactor coolant, 17: 28435 (IDO-16877)
NiO–ZrO_2, characterization of hot-pressed, 17: 27728(R) (GEAP-4076)

NICKEL PHOSPHIDES
electron structure and physical properties of crystals of, 17: 27875

NICKEL STEEL
Cr–Ni, corrosion by sodium at 1000°C, 17: 27756

NICKEL SYSTEMS
Al_2O_3–Ni, catalytic effects on isotope exchange between anisole or

xylene and deuterium oxide, 17: 27387
Ni–SiO_2, catalytic effects on isotope exchange between anisole or xylene and deuterium oxide, 17: 27387
Ni–Te, structure and superconductivity in, 17: 27816(T) (UCRL-Trans-921)

NIOBIUM
analysis for oxygen, 17: 27257
brazing, exothermic, 17: 27760(R) (NP-12901)
deformation texture of rolled, effects of impurities and processing on, 17: 27880
deformation, thermally activated, 17: 27879
determination in carbonatites, spectrographic, 17: 27228 (EUR-32.f)
distribution in zirconium oxide, use of electron microprobe for determination of, 17: 27746(R) (DPST-63-71-1)
internal friction in, 17: 27783(R) (GA-4227)
photon reactions with, proton angular distributions and yields at >8 Mev, 17: 28265
reactions with uranium-bearing reactor fuels, 17: 27961
separation from hydrochloric, nitric, and sulfuric acid solutions by solvent extraction using *N*-benzoylphenylhydroxylamine, 17: 27305
separation from tantalum and titanium, methods for, 17: 27401
separation from thorium using liquid-metal extraction, 17: 28465 (TID-7650(p.436-53))
superconducting transitions of gallium–vanadium and niobium–tin coated wires of, mechanical constraint effects on, 17: 28098
thermodynamic properties of, bibliography on, 17: 27793 (NP-12938)

NIOBIUM ALLOYS
phase diagrams of binary and ternary, 17: 27778 (DMIC-183)
properties for alkali metal containment, research on, 17: 27535 (BNL-801)
Al–Nb–Sn, superconducting properties of Nb_3SnAl, 17: 27861
Al–Nb–Sn–Ti, oxidation by air at 760 to 1360°C, 17: 27780(R) (DRI-2104)
Al–Nb–Zr, hardness, 17: 27779(R) (DRI-2102)
Al–Ni–Nb, crystal structure of intermetallic compounds in, 17: 27928
Al–Ni–Nb, reactions between Ni_2Al and Ni_2Nb in, 17: 27827
Be–Nb, oxidation of aluminum-containing $NbBe_{12}$ and Nb_2Be_{17} at 650 to 1000°C, 17: 27781(R) (DRI-2105)
Co–Nb, phase studies, 17: 28565(R) (LAMS-2915)
Cr–Nb, phase diagram, 17: 27825
Cr–Nb–Ti, phase studies, 17: 27826
Cr–Ni–Nb, phase diagram, 17: 27825
Cu–Nb–Zr, hydrogenation of, delayed failure from, 17: 28533(R) (SRO-83)
Ge–Nb–Sn, superconducting properties of Nb_3SnGe, 17: 27861
Hf–Nb–W, preparation and properties of, 17: 27779(R) (DRI-2102)
Mo–Nb–Ta–W, tensile properties, 17: 27812(R) (WADD-TR-61-134(Pt.II))
Mo–Nb–W–Zr, tensile properties, 17: 27878
Nb–Re, rolling of, 17: 27733(R) (NMI-2116)
Nb–Sn, mechanical constraint effects on superconducting transitions of niobium wires coated with, 17: 28098
Nb–Ti, superconducting critical currents at 4.2°K, 17: 28101
Nb–U, transformation of retained β phase in, by tempering from $\beta + \gamma$, range, kinetics of, 17: 27824
Nb–W, fabrication and tensile properties of, effects of carbides on, 17: 27812(R) (WADD-TR-61-134(Pt.II))
Nb–W–Zr, preparation and properties of, 17: 27779(R) (DRI-2102)
Nb–Zr, a-c losses in superconducting wires of, 17: 28099
Nb–Zr, corrosion by uranyl sulfate solution at 280°C, in-pile, 17: 27750 (ORNL-3099)
Nb–Zr, critical current in magnets of, 17: 27944 (NP-12908)
Nb–Zr, hydrogen overvoltage measurements in, 17: 27728(R) (GEAP-4076)
Nb–Zr, properties during superconducting transition, 17: 27942 (NIRL/R/32)
Nb–Zr, superconducting properties for use in high-field magnets, 17: 28074
Nb–Zr, superconducting critical currents at 4.2°K, 17: 28101
Nb–Zr, thermodynamic properties of capsules of, 17: 27792 (NP-12933)
Sb–Nb–Sn, superconducting properties of Nb_3SnSb, 17: 27861

NIOBIUM CARBIDES
bibliography on properties, 17: 27809 (UCRL-7284)
properties of, dispersion velocity dependence on mechanical and thermal, 17: 27873

NIOBIUM COMPACTS
density, 17: 27829

NIOBIUM FLUORIDES
corrosive effects on INOR-8, Monel, and nickel, 17: 26944(R) (BMI-1630 (Del.))

NIOBIUM ISOTOPES Nb-95
content in children and stillborn infants, 17: 27013 (TID-18878)
content in vegetation in Italy, 1961, 17: 27591 (EUR-223.i)
content in vegetation in Northern Alaska from fallout, 17: 27053 (HW-SA-3050)

NIOBIUM MINERALS
industrial hygiene in mines, 17: 27603(T) (JPRS-19866)

NIOBIUM NITRIDES
electron structure and physical properties of crystals of, 17: 27875
sintering of, electron density in phase lattices and optimal conditions for, 17: 27767

NIOBIUM OXIDES
additive effects on thermal conductivity of uranium dioxide, 17: 27814(T) (EURAEC-103)
phase transitions and x-ray diffraction in, 17: 27788(R) (LRR-41)
Nb_2O_5–Ta_2O_5, equilibrium diagram of, 17: 27788(R) (LRR-41)
Nb_2O_5–WO_3, space groups and tetragonal unit cell for, 17: 27788(R) (LRR-41)

NIOBIUM SYSTEMS
Al–Nb–Si–Ti, oxidation by air at 760 to 1360°C, 17: 2280(R) (DRI-2104)
Nb–Si–Sn, superconducting properties of Nb_3SnSi, 17: 27861
Nb–UC, properties as thermionic cell emitters, 17: 27962

NITRATES
separation of rare earths and uranium from fused, by ion exchange, 17: 27500

NITRIC ACID
solvent properties of, for sintered uranium dioxide pellets, 17: 27338

NITRITES
detection in plutonium liquors, device for, 17: 27222(P)

NITROGEN
bond length measurement by electron diffraction, 17: 27358
compression of, second virial coefficients and volumetric behavior at 0 to −140°C, 17: 28077
determination in atmosphere in relation to argon using radiation attenuation gages, 17: 27564(R) (NYO-10219)
determination in sodium, volumetric, 17: 27232 (LA-2892)
effects on corrosion of Zircaloy-2 at high temperatures, 17: 27751 (WAPD-T-1567)
flow of liquid-vapor mixtures of, solutions for choking, 17: 28097
release from fused uranium dioxide fuel elements, 17: 28526(R) (DP-845)
ultraviolet refractive indices of gaseous, Cherenkov radiation method for vacuum, 17: 28028
ultraviolet refractive indices of gaseous, Rayleigh scattering method for vacuum, 17: 28029
use in space simulators, supply systems for, 17: 28078
x-ray scattering by, theory, 17: 27953

NITROGEN IONS
electron affinities of, relativistic and nonrelativistic, 17: 27996

NITROGEN ISOTOPES N-14
alpha reactions (α,p) at 22 Mev, angular distributions from, 17: 28288
deuteron reactions (d,n) at 5 Mev, hyperfine structure, nuclear magnetic dipole moment, and spin from, 17: 28311

NITROGEN ISOTOPES N-15
gamma reactions (γ,p) at 24.5 and 31 Mev, proton spectra from, 17: 28294

NITROGEN MUSTARDS
genetic effects in Drosophila, 17: 27099

NITROGEN OXIDES
bond length measurement by electron diffraction, 17: 27358
scavenging deuterated methyl radicals by nitric, at low temperature, 17: 27337

NITROGEN SYSTEMS
He–N, second virial coefficients and volumetric behavior at 0 to −140°C, 17: 28077

Hg–N, flow characteristics for two-phase, 17: 27535 (BNL-801)
N–Pu, phase studies, 17: 28565(R) (LAMS-2915)

NOISE
absorption of cosmic radio, in ionosphere, 17: 28016
absorption of cosmic radio, auroral chorus activity and K-index correlation to ionospheric, 17: 28122
suppression of photomultiplier, method for, 17: 27657 (UCRL-6886 (Rev.1))

NONANE
polarization of irradiated, high voltage relaxation, 17: 27469
radioinduced reactions of, with carbon dioxide, yields in, 17: 27458

NUCLEAR BATTERIES
design of semiconductor, 17: 27531(P)

NUCLEAR CHEMISTRY
research in, 17: 28247(R) (TID-18788)

NUCLEAR EMULSIONS
deposition of thin layers of, on electron microscope preparations, 17: 27644
meson (π^-) reactions at 4.6 Bev/c, lithium-9 decay in, 17: 28274
sensitivity of, as function of temperature, 17: 28168
use for dosimetry of fast neutrons, methodological errors in, 17: 27692

NUCLEAR HEATING PLANTS
design for water desalinization, 17: 28499

NUCLEAR MAGNETIC RESONANCE
spectra of, analysis of high-resolution, 17: 28293

NUCLEAR MODELS
isomerism probabilities in statistical, 17: 28343
transformation in superconductive, accuracy of u-v, 17: 28242 (JINR-P-1259)

NUCLEAR MODELS (DROP)
deformation energy and fission behavior in, 17: 28262
equilibrium shapes of rotating charged drop, 17: 28258 (UCRL-10775)

NUCLEAR MODELS (SHELL)
analysis of oxygen energy level spectra by, 17: 28302

NUCLEAR PHYSICS
analysis of monoenergetic Boltzmann equation, Lagrangian variational, 17: 28412
analysis of monoenergetic Boltzmann equation, self-adjoint transformation in Lagrangian variational, 17: 28413
book: *Nuclear Physics*, 17: 28344

NUCLEAR POWER
developments in, as potential market for uranium, 17: 26957
economic aspects of continuance of Civilian Nuclear Power Program, 17: 28532 (SRIA-65)

NUCLEAR POWER PLANTS
accidents in, arrangement for preventing pressure buildup in steam-releasing, 17: 28550(P)
check-out procedures before start-up of Latina, 17: 28537
design, 17: 28558(P)
design for direct conversion, 17: 28560(P)
design of boiling-reactor, 17: 28555(P)
design of, with superheating, 17: 28549
development of Garigliano station, quarterly summary, 17: 28530(R) (NP-12909)
energy conversion in, MHD, 17: 28548
heat rejection by space, research on, 17: 27535 (BNL-801)
operation of simulated Rankine-cycle, for space applications, 17: 28574(R) (PWA-2197)
research on thermionic, 17: 27535 (BNL-801)
size of future, 17: 28541

NUCLEAR REACTIONS
analysis of, MONSTER program for, 17: 28246 (NDA-Memo-2123-1)
angular distributions and Q-values for, 17: 28239 (ANL-6718)
bibliography on chemical effects of transformations, 17: 27421 (NP-12894)
mechanisms in heavy-ion-induced, 17: 28258 (UCRL-10775)

NUCLEAR THEORY
book: *Lectures on Nuclear Theory*, 17: 28415
book: *On the Interaction Between Atomic Nuclei and Electrons*, 17: 28345
description of superconducting-superfluid Fermi-fluid, 17: 28069
impulses of nucleon pairs in, solution of Bethe-Goldstone equation for, 17: 28330

NUCLEI
carbon-12 and oxygen-16 reactions with, total cross sections for, 17: 28256 (UCRL-10766)
electron inelastic scattering at high energies, isospin selection rules for, 17: 28326
electron reactions with, 17: 28345
energy levels of, probabilities for isomeric, 17: 28343
fission of heavy compound, ternary, 17: 28257 (UCRL-10772)
gamma Mossbauer scattering by impurity, in solids, 17: 28340
gamma spectra of, Fermi-fluid theory for, 17: 28069
impulses of nucleon pairs in, solution of Bethe-Goldstone equation for, 17: 28330
isotopic effects on spectra, 17: 27396
meson (K^-) reactions at 800 Mev/c, hyperon (Λ) beta decay branching ratio from, 17: 28192
meson (μ) reactions on, mesons (π) from, 17: 28341
meson (π^-) reactions at 4.6 Bev/c, lithium-9 decay in, 17: 28274
neutron capture by, statistical analysis of levels in, 17: 28282
neutron reactions with, angular distributions for fast, 17: 28240 (BNL-400(Vols.I and II))
nucleon binding energy in $6 \leq Z \leq 100$, formula for, 17: 28273
nucleon inelastic scattering by, test of impulse approximation for, 17: 28300
orientation of, design of helium-3 cryostat for, 17: 28092
proton inelastic scattering by complex, angular distributions for mesons (π) from, 17: 28304
reactions of complex, product charge distributions for, 17: 28253 (UCRL-10741)
reactions with heavy ions, 17: 28258 (UCRL-10775)
reactions with ions, properties of isomeric states of thallium produced in, 17: 28255 (UCRL-10764)

NUCLEI (CELLS)
radiation effects on protein content, 17: 27157
radiation effects on nucleoli in Chang liver cells, 17: 27063 (TID-18846)
radioinduced luminescence of chemicals, 17: 27065 (UCRL-10724)

NUCLEIC ACIDS
radiation effects on binding of chromium-51 by liver, 17: 27084
radiation effects on magnetic properties of, 17: 27432

NUCLEONS
binding energy of, formula for nuclei $6 \leq Z \leq 100$, 17: 28273
form factors, effect of inelastic processes in meson (π)–meson (π) scattering on, 17: 28198
interaction resonance state ($\bar{K}$-N) coupling to (Σ-π), 17: 28136 (BNL-6363)
interactions of, nonlocal even parity, 17: 28187
interactions with mesons, algebraic equations for describing, 17: 28142 (JINR-E-1262)
interactions with photons, unitary symmetry model for pseudoscalar meson production in, 17: 28149 (LNF-63/21)
interactions with neutrinos, cross sections for, 17: 28151 (NEVIS-111)
interactions with mesons (K), resonance, 17: 28172
interactions with antinucleons, resonance model of, 17: 28197
interactions with mesons (π^-) at 7 Bev, peripheral, 17: 28208
interactions with mesons (π) and nucleons, amplitudes for, 17: 28212
interactions with nucleons, solution of Bethe-Goldstone equation for hard-core potential in, 17: 28330
properties, 17: 28160 (UCRL-10842)
scattering by nuclei at high energies, test of impulse approximation for inelastic, 17: 28300
scattering cross sections for, asymptotic relations for, 17: 28218
scattering from nonlocal optical potentials, computer program for, 17: 28155 (ORNL-3429)

NUCLEOTIDES
radiation effects on thymocyte, 17: 27085
synthesis, tracer study, 17: 26982
ultraviolet radiation effects on dimer formation, 17: 27079

NUCLEOTIDES, PYRIDINE TRIPHOSPHATE
chemical and radiation effects on, in tumor cells, 17: 27035

O

OILS
radiation effects on drying, 17: 27926

separation from butyl phosphate–kerosene system used in ore refinery, 17: 27405 (NLCO-882)
OLEIC ACID
radiosensitivity effects on diploid and haploid yeast, cosmic, 17: 27199
OPTICAL SYSTEMS
design of, using LASL automatic lens-designing code, 17: 27940 (LA-2877)
ORES
analysis for alkali metals, method for, 17: 27243(T) (AEC-tr-5822)
analysis for beryllium oxide, photometric, 17: 27302
analysis for metal content of, beta radiation method for, 17: 27283
ORGANIC COMPOUNDS
isotope effects in, intermolecular-insertion, 17: 27411
radioactivity measurement of carbon-14-labeled, using scintillation liquids, absolute, 17: 27453
ORGANIC COMPOUNDS, METALLO-
bonding of methylmercury to tobacco mosaic virus, method for, 17: 27043
ORGANIC COOLED REACTORS
buckling and void effects in heavy-water-moderated, with uranium dioxide rod clusters, 17: 28483 (TID-18895)
coolant-moderator system for, design of improved, 17: 28508(P)
criticality studies of ORGEL, design and operation of ECO assembly for, 17: 28427 (EUR-130.f)
development of heavy-water-moderated, for desalination plants and power production, 17: 28526(R) (DP-845)
shielding design and evaluation for ORGEL critical experiment, 17: 28428 (EUR-149.f)
steam cycles for ORGEL, 17: 28424 (EUR-83.f)
ORGANIC MODERATED REACTOR EXPERIMENT
coolant processing by hydrocracking high boilers, 17: 28435 (IDO-16877)
coolant properties studies for Cores II and III, 17: 27423(R) (TID-18195)
ORGANIC MODERATED REACTORS
component testing for P.R.O., 17: 28488
coolant-moderator system for, design of improved, 17: 28508(P)
ORGANS
radiation effects on tritium content in mouse, 17: 27181
OSCILLATORS
behavior of nonlinear coupled, 17: 28025
OSMIUM
book: *Ruthenium and Osmium, Bibliographic Guide to Literature (1804–1960)*, 17: 27400
spectra of, gyromagnetic ratios for, 17: 27938 (BNL-6396)
OTTAWA RIVER
monitoring for radioactivity in vicinity of Chalk River Nuclear Laboratories, 1962, 17: 27585 (AECL-1765)
OXAZOLES, 2,5-DIARYL-
fluorescence of naphthalene-containing, characteristics of, 17: 27451
OXYGEN
bond length measurement by electron diffraction, 17: 27358
determination in liquid metals, 17: 27731 (NASA-TM-X-884)
determination in materials, methods for, 17: 27293
determination in niobium, tantalum, and vanadium, 17: 27257
determination in sodium, use of mercury method for, 17: 27245(T) (AEC-tr-5840)
diffusion in silver, pressure and temperature dependence of, 17: 27821
effects on corrosion of Zircaloy-2 at high temperatures, 17: 27751 (WAPD-T-1567)
effects on peroxide formation in radiolysis of polymethylmethacrylate and copolymer with polystyrene, 17: 27475
effects on radioinduced graph polymerization of acrylonitrile to acetates and cottons, 17: 27634(R) (NCSC-2477-4)
exchange between magnesia and water at 50 and 100°C, 17: 27313(R) (ASD-TDR-62-843)
excitation, ionization, and photoionization cross sections for, 17: 27948(R) (TID-18921)
flow of liquid, solid formation in, 17: 28084
flow of liquid-vapor mixtures of, solutions for choking, 17: 28097
motion in thorium (IV) oxides containing calcium oxides, electrical and mechanical relaxation from vacancy, 17: 27869
neutron cross sections for, fast, 17: 28245 (KFK-120)
partition coefficients and reciprocal ionic radii, 17: 27562 (INSJ-54)
use in chemical regeneration of sublimating metallic surfaces in thermionic cells, 17: 27968
yields in radiolysis of potassium dichromate in sulfuric acid, 17: 27466
OXYGEN IONS
electron affinities of, relativistic and nonrelativistic, 17: 27996
OXYGEN ISOTOPES
use of oxygen-18/oxygen-16 ratio in ground water flow studies, 17: 27565 (RT/GEO(63)-25)
OXYGEN ISOTOPES O-15
energy levels of, hyperfine structure, nuclear magnetic dipole moment and spin of ground-state, 17: 28311
OXYGEN ISOTOPES O-16
carbon-12 and oxygen-16 reactions with, magnesium-24 and silicon-28 parity and spin from, 17: 28324
energy levels, theoretical study, 17: 28264
reactions at 167 Mev, charged-particle yields from, 17: 28252 (UCRL-10693)
reactions with gold at 142 and 164 Mev, neutron production in, 17: 28251 (UCRL-10689)
reactions with holmium-165, terbium-159, and thulium-169, energy levels in coulomb-excitation, 17: 28299
reactions with nuclei at 150 Mev, total cross sections for, 17: 28256 (UCRL-10766)
reactions with oxygen-16, magnesium-24 and silicon-28 parity and spin from, 17: 28324
reactions with praseodymium-141, product charge distribution from, 17: 28253 (UCRL-10741)
reactions with tin-124, effects of angular momentum on excitation functions of, 17: 28346
reactions with uranium-238, half life of spontaneously fissionable isomer from, 17: 28241 (JINR-P-1258)
scattering by tantalum-181 at 166 Mev, inelastic contributions to elastic, 17: 28259 (UCRL-10825)
OXYGEN ISOTOPES O-17
energy level spectra of, shell model analysis, 17: 28302
OXYGEN ISOTOPES O-18
energy level spectra of, shell model analysis, 17: 28302
proton reactions (p,γ) at 570–1500 kev, gamma angular distributions from, 17: 28290
OXYGEN ISOTOPES O-19
energy level spectra of, shell model analysis, 17: 28302
OXYGEN ISOTOPES O-20
energy level spectra of, shell model analysis, 17: 28302
OXYGEN SYSTEMS
C–O–U, phase studies on, 17: 27802 (TID-18809)
O–Zr, crystal structure of, ligand field theory of, 17: 27817
OXYTOCINS
protective effects of, against toxicity of 2,2'-dichloro-*N*-methyldiethylamine, 17: 27030
OZONE
effects on radiation avoidance, in mice, 17: 27175

P

PACKAGING
requirements for shipping radioisotopes, 17: 27586 (AHSB(RP)R-23)
PACKED COLUMNS
dispersion in, longitudinal, 17: 27544 (UCRL-10696)
performance of fused salt-liquid metal extraction, axial mixing and mass transfer in, 17: 27492 (BNL-791)
PAINTS
radiation hazards from promethium-147-activated luminous, 17: 27619
resistance of, to irradiation, review of factors affecting, 17: 27752
yellowing of solar reflector, in intense ultraviolet radiation in vacuum, 17: 27506 (NP-12906)
PAIR PRODUCTION
gamma, in polarized electron-positron annihilation, 17: 28214
PALLADIUM
catalytic effects on isotope exchange between anisole or xylene and deuterium oxide, 17: 27387
catalytic effects on hydrocracking of polyphenyls, 17: 28434 (IDO-

16858)
determination in fissium–uranium alloys, fluorescent x-ray spectrometric, 17: 27255
PALLADIUM ALLOYS
Be–Pd, wetting behavior of liquid, on solid beryllium, effects of atmosphere and temperature on, 17: 27795 (ORNL-3438)
Pd–Zr, corrosion by uranyl sulfate solution at 280°C, in-pile, 17: 27750 (ORNL-3099)
PALLADIUM ISOTOPES Pd-104
deuteron reactions (d,p) and (d,t) at 15 Mev, nuclear structure from, 17: 28315
PALLADIUM ISOTOPES Pd-105
deuteron reactions (d,p) and (d,t) at 15 Mev, nuclear structure from, 17: 28315
PALLADIUM ISOTOPES Pd-106
deuteron reactions (d,p) and (d,t) at 15 Mev, nuclear structure from, 17: 28315
PALLADIUM ISOTOPES Pd-108
deuteron reactions (d,p) and (d,t) at 15 Mev, nuclear structure from, 17: 28315
PALLADIUM ISOTOPES Pd-111
production in rhodium-111 decay, ratio to palladium-111m, 17: 28280
PALLADIUM SYSTEMS
Pd–Te, structure and superconductivity in, 17: 27816(T) (UCRL-Trans-921)
PAPER
ignition by nuclear explosions, effects of burst heights and atmospheric conditions on, 17: 27945 (NP-12936)
PARAMECIUM
mutations of *Paramecium aurelia*, 17: 26979
PARTICLE TRACKS
geometrical reconstruction methods for, in bubble chambers, 17: 27686 (NIRL/R/14)
PARTICLE TRAJECTORIES
determination in slowly varying electric and magnetic fields, approximations for, 17: 28017
PEAT
sorptive properties of, for antimony-124, iron-55 and -59, and zinc-65, 17: 27284
PECTINS
radiation effects on, in plants, 17: 27088
2,4-PENTANEDIONE
benzene-2,4-pentanedione, solvent properties for scandium, 17: 27369
butyl acetate-2,4-pentanedione, solvent properties for scandium, 17: 27369
chloroform-2,4-pentanedione, solvent properties for scandium, 17: 27369
PENTANES
radioinduced chlorination of chlorinated, effects on octachlorocyclopentene yield in, 17: 27480
PEROXIDES
formation in radiolysis of polymethylmethacrylate and copolymer with polystyrene, 17: 27475
PERSONNEL
radiation effects on blood of medical, data on, 17: 27620
survival during nuclear warfare, rations for, 17: 27621
PERTURBATION THEORY
density matrix equations of motion in, 17: 27991
development for random time intervals, 17: 28203
dispersion relations in, integral representations of, 17: 28213
fermion Regge poles in, 17: 28217
for nonlinear coupled oscillators, 17: 28025
scattering amplitudes in, high-energy behavior of, 17: 28164
scattering amplitudes in, high-energy behavior of, 17: 28166
scattering amplitude behavior in, high-energy, 17: 28176
spectral representations of inelastic amplitudes in, 17: 28209
vertex functions in, asymptotic values of relativistic, 17: 28216
PESTICIDES
removal from foods, tracer method for evaluating, 17: 27638 (SAN-1021)
PETROLEUM
preparation of radiation-resistant mineral oils, 17: 27530(P)
production of, sequestration of metal ions in brines obtained in, 17: 27320(R) (ORO-602)
stability of hydrocarbon fuel oils, improvement by irradiation, 17: 27647(P)
PHANTOMS
depth-dose distribution of 160-Mev proton beam in water-filled spherical, 17: 27059 (ORNL-3457)
dose distribution in, design of miniature tissue equivalent ionization chambers for determination of, 17: 27076
PHARMACEUTICALS
radiosterilization, 17: 27424
PHENOLPHTHALEIN
color change induced in, by unknown x-agent, 17: 27452
PHENOLS
methylamino-, polarographic studies of uranyl complex of, 17: 27340
PHENOTHIAZINES
chloro-, protective effects of, against toxicity of 2,2'-dichloro-*N*-methyldiethylamine, 17: 27030
PHENYL ETHER
phosphorus salt, effects on retention of uranyl nitrate by rat kidneys, 17: 27025
PHOSPHATASES
content in liver and spleen of irradiated mice, effect of hematopoietic tissue injection on, 17: 27111
PHOSPHATE IONS
determination in fertilizers and ion exchangers by double-decomposition radio-release technique, 17: 27233(R) (ORO-588)
PHOSPHATES
determination of ortho-, rapid titrimetric, 17: 27258
PHOSPHINE OXIDE, TRIOCTYL-
complexes with uranyl ion–di-(2-ethylhexyl) phosphoric acid, spectrophotometric analysis of synergic solvent extraction system of, 17: 27497
PHOSPHINES
heat of formation, 17: 27322 (UCRL-7301-T)
PHOSPHONITRILE CHLORIDES
radioinduced polymerization of solid, 17: 27474
PHOSPHORIC ACID, ALKYL ESTERS
complexes with uranyl ion–tri-(n-octyl) phosphine oxide, spectrophotometric analysis of synergic solvent extraction system with di(2-ethylhexyl), 17: 27497
PHOSPHORODITHIOIC ACID
dialkyl esters of, acid dissociation constants and solvent partition coefficients of, 17: 27407
PHOSPHOROTHIOIC ACID
dibutyl ester of, solvent properties for metals from aqueous solutions, 17: 27408
PHOSPHORS
luminescence of powdered, electric-field-induced, 17: 27342
response of liquid argon to protons up to 50 Mev, 17: 28059
PHOSPHORUS
content in zirconyl phosphates, ratio to zirconium, 17: 27351
metabolism in leukocytes, effects of staphylococcal leukocidin on, 17: 27028
neutron activation rates for, fast, 17: 28221 (EUR-107.f)
radiation effects on silicon crystals doped with, illumination and temperature dependence of gamma, 17: 27898
urinary excretion in rats, effects of methionine and x radiation sulfoximine, 17: 27037
PHOSPHORUS ISOTOPES P-31
alpha reactions (α,p) at 22 Mev, angular distributions from, 17: 28288
energy levels of, properties of excited state, 17: 28321
PHOSPHORUS ISOTOPES P-32
analysis of, for impurities by passing through humus column, 17: 27284
beta emission from, determination of end-point energy of, 17: 28183
beta sorption from, as function of atomic number, 17: 28184
effects on differentiation and growth of tadpoles, 17: 27072
neutron total cross sections at 3–5 Mev, fast, 17: 28287
preparation of carrier-free, by neutron irradiation of sulfur, 17: 28272
radiodiagnostic use for cervical carcinoma, 17: 26968
sorption by lead and strontium sulfates, effects of iron(III) on, 17: 27363
use of, for diagnosis of tumors in female genital organs, 17: 26995
PHOTOCONDUCTIVITY

measurement in irradiated dielectric films, 17: 27893 (TID-18843)
measurement in irradiated dielectric films, 17: 27895 (TID-18857)
PHOTODEUTERONS
production in photon reactions (γ,d) with antimony, copper, nickel, and tin at 24 Mev, yields for, 17: 28289
PHOTOGRAPHIC FILM
radiation effects on, cosmic, 17: 27924
PHOTOGRAPHIC FILM DETECTORS
development techniques for measurement of radiation exposures to 10,000 r, 17: 27594 (NBS-TN-161)
PHOTOGRAPHY
aerial, conference on, 17: 27563 (NP-12932)
data storage by, PEM system for, 17: 26949 (TID-18887)
techniques for plasma dynamics, 17: 28386
PHOTOMULTIPLIER TUBES
gain stabilization in, device and method for, 17: 27675(P)
noise level suppression method for, 17: 27657 (UCRL-6886(Rev.1))
response to single electrons, amplitude distribution of, 17: 27659
PHOTONS
color effects in methyl red and phenolphthalein solutions, 17: 27452
exchange and interactions in electron scattering, diagrams for, 17: 28166
interactions with nucleons, unitary symmetry model for pseudoscalar meson production in, 17: 28149 (LNF-63/21)
reactions (γ,d) and (γ,p) with antimony, copper, nickel, and tin at 24 Mev, yield ratios for, 17: 28289
reactions (γ,n) with sulfur-32 at 22 Mev, cross sections for, 17: 28286
reactions with nuclei $13 \leq Z \leq 50$, proton angular distributions and yields at >8 Mev, 17: 28265
theory of rest mass of, as mechanism for geothermal balance, 17: 27578
PHOTOPROTONS
production in photon reactions (γ,p) with antimony, copper, nickel, and tin at 24 Mev, yields for, 17: 28289
production on nuclei $13 \leq Z \leq 50$, angular distributions and yields at >8 Mev, 17: 28265
PHYSICS
book: *Elements of Numerical Analysis and Mathematical Processing of Experimental Results*, 17: 27726
matrix elements for vector operators, representation of, 17: 28182
PICOLINES
complexes with calcium and strontium thiocyanates, 17: 27332
PINCH DEVICES
bibliography, 17: 28361 (NP-12921)
resonant modes of z-type, 17: 28373
PINCH EFFECT
production in cylindrical plasma motion, two-fluid model for, 17: 28378
production in cylindrical plasma, hydromagnetic theory of transient, 17: 28379
PIPE JOINTS
design for coupling dissimilar metal tubes, 17: 27529(P)
PIPES
flow in vertical, void fractions for boiling heavy water, 17: 27532 (AE-106)
fluid flow in, radioactive tracer method for determining, 17: 27680(P)
requirements of pressurized, computer program for calculating minimum, 17: 27511 (WAPD-R(WB)-2)
PITUITARY GLAND
radionecrosis by implanted yttrium-90, 17: 27191
PLACENTAL TISSUES
analysis of human, for strontium-90 content, 17: 27033
PLANETS
flight to Mars, dual electric-nuclear engine parameters for round-trip, 17: 28575
radio emission (610-Mc) from Jupiter, 17: 28114
rendezvous of Mariner II with Venus, 17: 28577
PLANKTON
radiation effects on chemical composition and physical properties of red seaweed, 17: 27132
PLANT CELLS
radiation effects on proteins in, 17: 27134
PLANT METABOLISM
tracer studies, bibliography, 17: 27635 (NP-12928)
tracer studies, bibliography, 17: 27636 (NP-12929)
PLANTS
analysis for element deficiencies, activation, 17: 27310(P)
calcium exchange with soil, tracer study, 17: 27046
effects of irradiated pollen on self-fertilization of corn, 17: 27091
fallout levels in Italian, 1961, 17: 27591 (EUR-223.i)
monitoring for fallout in, in Northern Alaska, 1961–62, 17: 27053 (HW-SA-3050)
radiation effects on higher, cosmic, 17: 27196
radiation effects on higher, cosmic, 17: 27201
radiation effects on root growth of, 17: 27068(T) (CEA-tr-R-1678)
radiation effects on cellulose, hemicellulose, lignin, and pectin in, 17: 27088
radiation effects on, genetic, 17: 27100
radioactive contamination of grass, moss, and lichens with long-lived fission products, 17: 27604
radiosensitivity, effects of chromosome size, 17: 27153
radiosterilization of asparagus, cauliflower, and tomatoes, effects of, on storage, 17: 27096
water status in tissues of, methods for estimation of, 17: 26969
PLASMA
beam penetration in magnetic barrier, condition affecting gradient of magnetic field, 17: 28372
bibliography, 17: 28361(NP-12921)
book: *Electrically Energized Shock Tubes*, 17: 28402
containment by orthogonal standing waves, three-dimensional, 17: 28396
containment of flowing, design of device for, 17: 28404(P)
current density in, effects of magnetic field on, 17: 28397
diffusion from line source in magnetic field, particle densities and temperatures in, 17: 28365 (UCRL-10801)
dynamics of, photographic techniques for, 17: 28386
electric discharges in, characteristics of partially ionized, 17: 28380
electromagnetic radiation from filament clad by anisotropic sheath of, 17: 28369
electromagnetic wave propagation in, in direction of impressed magnetic field, 17: 28398
electron and ion energies in, free spherical probe for measurement of, 17: 28376(T)
electron density in, gas laser as infrared interferometer for measuring, 17: 28367
electron reactions with atoms in cesium, 17: 27955
equilibrium of current-carrying toroidal, magnetic field effects on, 17: 28392
equilibrium of current-carrying toroidal, in stellarator (c), 17: 28393
heating by sinusoidally-fluctuating magnetic field, 17: 28364 (UCRL-7294)
hydromagnetic wave propagation near ion cyclotron resonance in, 17: 28391
hydromagnetic wave absorption by, quasilinear approximation for, 17: 28399
hydromagnetic waves in, nonlinear one-dimensional, 17: 28401
impurity atoms in, solution of differential equations for, 17: 28359 (CLM-R-3)
interaction between charged particles and totality of electrons in, theory of, 17: 28384
interactions in electron, renormalization constant for, 17: 28377
interactions with magnetic dipoles, characteristics of, 17: 28381
ion cyclotron resonance in, detection system for, 17: 28383
ion injection device for thermonuclear, design of, 17: 28405(P)
kinetics, 17: 27539(R) (NP-12767(p.10–12))
magnetohydrodynamic wave propagation in, 17: 27540(R) (NP-12767(p.65–7))
motion and structure of, in rail spark gap, 17: 28395
motion of perfectly conducting, momentum equation from variational principle for, 17: 28388
neutral atoms and molecules in Stellarator (c), source of, 17: 28348 (MATT-161)
oscillations in magnetic fields, transverse-drift, 17: 28400
oscillations in synthetic beams of, 17: 28394
oscillations in, two-particle distribution function for collisional damping of, 17: 28387
penetration of a neutralized ion-electron beam into a magnetic barrier, 17: 28370

pinch effect in cylindrical, hydromagnetic theory of transient, 17: 28379
pinch motion of cylindrical, two-fluid model for, 17: 28378
properties in Kaufman-type ion motor, 17: 28360 (JPL-TR-32-417)
properties of cesium, thermodynamic and transport, 17: 27956
quantum number for, maximum bound principal, 17: 28363 (UCRL-6981-T(Rev.I))
radiation absorption and emission by fully-ionized, in magnetic fields, 17: 28358 (ARL-63-62)
research on fast-wave cyclotron amplifier, 17: 28357(R) (AD-290086)
research on, in fast-wave cyclotron amplifiers, 17: 27650(R) (AD-297382)
resonance of hollow, electron density from electrostatic, 17: 28374
spectra of equilibrium, calculation of energy emitted in, 17: 28385(T)
spectra of, theory of self-absorption, 17: 27294(T)
stability from partially ionized gas discharge oscillations in, 17: 28382
stability in stellarator, interchange, 17: 28389
wave propagation in tubular, 17: 28390
wave propagation in unbounded, magnetic field effects on l-f, 17: 28375

PLASMA JETS
development for space propulsion, 17: 28362 (NP-12935)
magnetic induction parameter for Lorentz, 17: 28366
thermodynamics, 17: 27538(R) (NP-12767)
use in ceramic microsphere production, 17: 27789(R) (MLM-1156)
use in chemical processing and materials working, advances in, 17: 26960

PLASTIC FILMS
radiation effects on polyamide fibers and films, 17: 27933

PLASTICS
performance under simulated space conditions, 17: 27506 (NP-12906)
properties at low temperatures, 17: 28090

PLATES
deflection of parallel, induced by flow, 17: 27552

PLATINUM
analysis for microimpurities in solid, spectrographic, 17: 27308
beta emission by, determination of end-point energy, 17: 28183
catalytic effects on hydrocracking of polyphenyls, 17: 28434 (IDO-16858)
catalytic effects on isotope exchange between anisole or xylene and deuterium oxide, 17: 27387
catalytic effects on isotope exchange between deuterium and toluene, 17: 27389
corrosion by cesium vapor, 17: 27965
corrosion by uranyl sulfate solution at 280°C, in-pile, 17: 27750 (ORNL-3099)
gamma reactions at 1–2 Mev, electron pair cross section Z-dependence from, 17: 28275
radioinduced oxidation and reduction of, in alkaline solutions, 17: 27442

PLATINUM ALLOYS
Co–Mo–Pt, catalytic effects on hydrocracking of polyphenyls, 17: 28434 (IDO-16858)
Pt–Rh, beta sorption as function of atomic number, 17: 28184
Pt–Zr, corrosion by uranyl sulfate solution at 280°C, in-pile, 17: 27750 (ORNL-3099)

PLATINUM ELECTRODES
hydrogen isotope separation factor in electrolytic evolution from, 17: 27716
hydrogen isotope separation in electrolytic evolution from, effects of overvoltage on, 17: 27717

PLATINUM SYSTEMS
Al_2O_3–Pt, catalytic effects on hydrocracking of high boilers in reactor coolant, 17: 28435 (IDO-16877)
Pt–Te, structure and superconductivity in, 17: 27816(T) (UCRL-Trans-921)

PLOWSHARE PROJECT
survey of applications of nuclear explosions, 17: 26958

PLUTONIUM
analysis of liquors for nitrite, device for, 17: 27222(P)
crystal structure of, indexing powder diffraction patterns for analysis for, 17: 27786 (LADC-5522)
crystal structure of alpha, 17: 27787 (LADC-5523)
depolymerization, polymerization, and precipitation of, effects of acidity and temperature on, 17: 27319 (ORNL-TM-585)
determination by complexometric titration using EDTA, 17: 27250
determination, coulometric, 17: 27248
determination in presence of uranium in alloys and compounds, x-ray spectrographic, 17: 27256
fabrication, 17: 27738
phase transformations in, 17: 27730(R) (HW-77052)
pricing of, as byproduct fuel, 17: 28546
properties as reactor fuel, 17: 27738
separation from fission products and uranium by solvent extraction using *N*-benzoylphenylhydroxylamine, 17: 27305
separation from fission products and uranium by ion exchange on zirconium phosphate silicate, 17: 27499
separation from hydrochloric, nitric, and sulfuric acid solutions by solvent extraction using *N*-benzoylphenylhydroxylamine, 17: 27305

PLUTONIUM ALLOYS
Al–Ni–Pu, fabrication by pneumatic injection casting, 17: 27758 (HW-69204)
Ce–Co–Pu, analysis by solvent extraction, 17: 27789(R) (MLM-1156)
Ce–Co–Pu, corrosive effects on tantalum, 17: 28565(R) (LAMS-2915)
Ce–Co–Pu, viscosities of, 17: 27789(R) (MLM-1156)
Ce–Cu–Pu, properties of, 17: 27789(R) (MLM-1156)
Ce–Ni–Pu, properties of, 17: 27789(R) (MLM-1156)
Fe–Pu, analysis of, 17: 27789(R) (MLM-1156)
In–Pu, phase studies, 17: 28565(R) (LAMS-2915)
La–Pu, phase studies, 17: 28565(R) (LAMS-2915)
Nd–Pu, phase studies, 17: 28565(R) (LAMS-2915)
Pu–Pr, phase studies, 17: 28565(R) (LAMS-2915)
Pu–Th–U, phase studies and properties, 17: 28470 (TID-7650(p.543-52))

PLUTONIUM CHLORIDES
properties of fused, as fuel for fast breeder reactors, 17: 27797 (PAN-414/V)

PLUTONIUM(VI) IONS
reactions with iron(III) ions at 0 to 25°C, 17: 27316 (LADC-5517)

PLUTONIUM ISOTOPES Pu-239
deposition in man, use of DTPA for elimination of, 17: 27208
deuteron fission at 7–21 Mev, cross sections and fragment angular distributions from, 17: 28314
neutron capture-to-fission ratios, thermal, 17: 28277
neutron cross sections for, fast, 17: 28245 (KFK-120)

PLUTONIUM NITRIDES
compatibility with liquid sodium at 600°C, 17: 26944(R) (BMI-1630 (Del.))

PLUTONIUM OXIDES
properties of pentavalent, comparison to americium, neptunium, and uranium, 17: 27350

PLUTONIUM(IV) OXIDES
production of pure microspheres of, 17: 27789(R) (MLM-1156)
PuO_2–UO_2, irradiation testing in VBWR, 17: 28431(R) (GEAP-4216)
PuO_2–ZrO_2, phase diagram, 17: 27836

PLUTONIUM RECYCLE TEST REACTOR
fuel element design and fabrication, 17: 27758 (HW-69204)
pressure-tube testing for, 17: 27730(R) (HW-77052)

PLUTONIUM SYSTEMS
N–Pu, phase studies, 17: 28565(R) (LAMS-2915)
Pu–Si, phase studies, 17: 28565(R) (LAMS-2915)

POLAND
radioactivity in foods, 1959 through 1961, 17: 27587 (CLOR-15)

POLONIUM COMPOUNDS
distillation of, with diphenylcarbazide, 17: 27349
volatility, 17: 27348

POLONIUM ISOTOPES Po-201
formation by proton reactions on bismuth, excitation functions for, 17: 28268

POLONIUM ISOTOPES Po-202
formation by proton reactions on bismuth, excitation functions for, 17: 28268

POLONIUM ISOTOPES Po-203
formation by proton reactions on bismuth, excitation functions for, 17: 28268

POLONIUM ISOTOPES Po-204
formation by proton reactions on bismuth, excitation functions for, 17: 28268

POLONIUM ISOTOPES Po-210
content in patients at Luchon, France, gamma spectra of, 17: 27042
determination in bone ashes, radiometric, 17: 27285
determination in samples of bone and teeth, radiochemical, 17: 27172
determination in minerals, radiochemical, 17: 27252
separation from bismuth-210 and lead-210 mixtures, use of diphenylcarbazide for, 17: 27349
separation from protactinium using arsenazo III and isoamyl alcohol, radiometric, 17: 27306
POLONIUM ISOTOPES Po-218
incorporation into aerosols for detection of submicroscopic particles, 17: 27643
POLYMERIZATION
from gaseous phase on solid base layers, 17: 27482
radioinduced, 17: 27926
radioinduced graft, 17: 27926
radioinduced, studies of, in solid phase, 17: 27484
POLYMERS
charged particle tracks in high, 17: 27925
radiation effects on, protective effects of sulfur, 17: 27438
radioinduced graft polymerization with wood, 17: 27896 (TID-18907)
POLYPHENYLS
analysis for chromium, iron, and nickel, x-ray spectrographic, 17: 27227 (EUR-28.f)
formation in radiolysis of deuterated and normal benzene—m-terphenyl, 17: 27418 (IDO-16876)
hydrocracking, 17: 28435 (IDO-16877)
hydrocracking of, evaluation of catalysts for selective, 17: 28434 (IDO-16858)
POPULATIONS
radiation exposure from natural sources in New England, 17: 27629
radiation protection of, public health responsibilities in, 17: 27630
PORCELAIN ENAMELS
thickness measurements of, use of sodium-24 for, 17: 27641
POROUS MATERIALS
vapor pressure of, measurement by the Knudsen effusion method, 17: 27341
POSITRONS
annihilation on polarized electrons, cross sections, 17: 28214
POTASSIUM
content in sedimentary rocks in gas and oil fields in Japan, 17: 27579
determination of total exchangeable, in man using potassium-42, 17: 27694
enthalpy at 0 to 1150°C, 17: 27792 (NP-12933)
exchange reactions with calcium, magnesium, and sodium on ion exchange resin, equilibrium constant for, 17: 27038
heat of fusion at 63.2°C, 17: 27792 (NP-12933)
heat transfer research on, 17: 27535 (BNL-801)
partition coefficients and reciprocal ionic radii, 17: 27562 (INSJ-54)
separation from alkali metal chlorides and chloroplatinates, method for, 17: 27243(T) (AEC-tr-5822)
specific heat at 0 to 1150°C, 17: 27792 (NP-12933)
POTASSIUM ALLOYS
K–Na, analysis of liquid, for oxygen, 17: 27731 (NASA-TM-X-884)
K–Na, performance of thermionic diodes with liquid collectors of, 17: 27988
K–Na, research programs on liquid, in France and Great Britain, 17: 27731 (NASA-TM-X-884)
POTASSIUM AZIDES
radiation effects on photoelectric properties of, 17: 27468
POTASSIUM BROMIDE CRYSTALS
neutron scattering by, structure factors for cold, 17: 27392(T)
spectra of, F-center positions in, 17: 27377
POTASSIUM CHLORIDE CRYSTALS
neutron scattering by, structure factors for cold, 17: 27392(T)
spectra of, F-center positions in, 17: 27377
POTASSIUM CHLORIDES
reactions with water, heat of, 17: 27323 (UCRL-7325-T)
CuCl–KCl, properties of fused, as simulated reactor fuels, 17: 27797 (PAN-414/V)
KCl–$ZnCl_2$, properties of fused, as simulated reactor fuels, 17: 27797 (PAN-414/V)
LiCl–KCl, solvent properties for thorium, 17: 28465 (TID-7650 (p. 436-53))
$MgCl_2$–KCl–NaCl, rate processes in packed column during bismuth extraction from, 17: 27492 (BNL-791)
POTASSIUM CHROMATES
radiolysis of di-, yields in, 17: 27466
POTASSIUM CRYSTALS
growth of thallium-activated, procedure for, 17: 28056
POTASSIUM FERRICYANIDES
radiolysis of acid solutions of, 17: 27441
POTASSIUM FERROCYANIDES
radiolysis of acid solutions of, 17: 27441
POTASSIUM FLUORIDE CRYSTALS
spectra of, F-center positions in, 17: 27377
POTASSIUM HYDROXIDES
effects on ion-exchange processes in boric acid solutions, 17: 27493 (WCAP-3716)
electron paramagnetic resonance spectra of, after irradiation at −150 and −196°C, 17: 27435
POTASSIUM IODIDES
protective effects of, against iodine-131 uptake by thyroid gland, 17: 27607
POTASSIUM ISOTOPES K-40
content in children, newborn infants, and stillborns, 17: 27013 (TID-18878)
POTASSIUM NITRATES
radioinduced radical formation in, annealing of, 17: 27422 (TID-17105)
POTASSIUM PHOSPHATES
hydrogen motion is dueterated and natural, low-frequency, 17: 27359
POTASSIUM URANYL FLUORIDES
bonding of, to tobacco mosaic virus, method for, 17: 27043
POTATOES
radiomimetic properties of gamma-irradiated, 17: 27158
POTENTIOMETERS
design and performance, 17: 27653 (IDO-16852)
POWDERS
crystal structure of, computer programs for indexing, 17: 27720 (HW-SA-2756)
POWER BREEDER REACTORS
future of fast, 17: 28544
future of thermal, 17: 28545
POWER REACTORS
design concepts for thorium-fueled aqueous and molten-salt, 17: 28457 (TID-7650(p.194-209))
design for water desalinization, 17: 28499
design of magnetohydroelectric, 17: 28551(P)
design of thermionic, 17: 28554(P)
development of German, survey, 17: 28535
development of heavy-water-moderated, 17: 28526(R) (DP-845)
development of SENN, quarterly summary, 17: 28530(R) (NP-12909)
fuel economy for, 17: 28546
fuel element reprocessing, design of plant for, 17: 28461 (TID-7650 (p.285-332))
future of boiling-water, 17: 28543
future of pressurized-water, 17: 28542
physics of gas-cooled, high-temperature, thorium-fueled, 17: 28454 (TID-7650(p.128-47))
steam cycles for ORGEL, 17: 28424 (EUR-83.f)
water chemistry problems in water-cooled, 17: 28538
POWER SUPPLIES
design of simplified radioactive, 17: 28578(P)
PRASEODYMIUM
partition coefficients and reciprocal ionic radii, 17: 27562 (INSJ-54)
PRASEODYMIUM ALLOYS
Pu–Pr, phase studies, 17: 28565(R) (LAMS-2915)
PRASEODYMIUM BORIDES
electron structure and physical properties of crystals of, 17: 27875
PRASEODYMIUM BROMIDES
spectra of, vibronic satellites associated with electronic transitions in, 17: 27312 (AROD-2099.13)
PRASEODYMIUM CHLORIDES
spectra of, vibronic satellites associated with electronic transitions in,

17: 27312 (AROD-2099.13)
PRASEODYMIUM IONS
spectra of bivalent, energy level parameters from, 17: 27353
spectra of, in lanthanum bromide and chloride crystals, covalency effects on shifts in, 17: 27311 (AROD-2099.12)
PRASEODYMIUM ISOTOPES Pr-141
oxygen-16 reactions, product charge distribution from, 17: 28253 (UCRL-10741)
reactions with neon-20, collision effects in, 17: 28258 (UCRL-10775)
PRASEODYMIUM ISOTOPES Pr-144
content in vegetation in Northern Alaska from fallout, 17: 27053 (HW-SA-3050)
PRASEODYMIUM OXIDES
spectra of, infrared absorption, 17: 27840
PRESSURE DROP
in superheaters, 17: 28522 (ACNP-62030)
PRESSURE GAGES
development for measurement of fission gases in operating fuel elements, 17: 27651 (GEAP-4135)
PRESSURE VESSELS
closure design for access holes in boiler, 17: 27528(P)
design for reactor cooling systems, 17: 28556(P)
design for reactor coolant conduits, 17: 28557(P)
design for ship propulsion reactors, 17: 28559(P)
strain measurements and analysis in EGCR, 17: 28482 (TID-18888)
PRESSURIZED WATER REACTORS
design analysis of thorium-fueled, 17: 28456 (TID-7650(p.172-93))
economics of thorium fuel cycle for, 17: 28479 (TID-7650(p.721-37))
heater passage design for, self-draining, 17: 28506(P)
role in future power plants, 17: 28542
water chemistry problems in, 17: 28538
PRODUCTION REACTORS
conversion factors of bare homogeneous, 17: 28421 (CNAM-5)
PROGESTERONE
effects of, on sulfur-35 uptake by uterine structures in guinea pigs, 17: 27034
PROMETHIUM
partition coefficients and reciprocal ionic radii, 17: 27562 (INSJ-54)
polarography in lithium chloride–ethyl alcohol solutions, 17: 27328
PROMETHIUM ISOTOPES Pm-147
beta emission of, use in nondispersive x-ray spectrochemical analysis, 17: 27280
incorporation in luminous paints, hazards in, 17: 27619
PROPANE
heat of formation, 17: 27322 (UCRL-7301-T)
neutron reactions (n,2n) in, phase dependence of carbon-11 recoil products for methylene insertion in, 17: 27415 (BNL-6354)
PROPANE, 2,2-DIMETHYL-
radiolysis of liquid, spur reactions in, 17: 27455
1,2-PROPANEDIOL
radiolysis of, in air and nitrogen, formation of products in, 17: 27424
1,3-PROPANEDIONE, 1,3-DIPHENYL-
benzene-1,3-diphenyl,1,3-propanedione, solvent properties for scandium, 17: 27369
butyl acetate-1,3-diphenyl,1,3-propanedione, solvent properties for scandium, 17: 27369
chloroform-1,3-diphenyl,1,3-propanedione, solvent properties for scandium, 17: 27369
1-PROPANOL
electron emission in, point air-flow counter for exo-, 17: 27688
2-PROPANOL
formation by radiolysis of propenediol in air and nitrogen, 17: 27424
radiation effects on dehydrogenation of, by nickel catalyst, 17: 27483
1-PROPANOL, 2-METHYL-
radiation effects on dehydration of, by nickel catalyst, 17: 27483
PROPENE
energy level density of deuterated and normal, vibrational, 17: 27367
isotope exchange with deuterium oxide, effects of nickel on, 17: 27390
radioinduced polymerization with tetrafluoroethylene, 17: 27476
radioinduced polymerization in aqueous silver salt solution, 17: 27478
ethylene–propene, radioinduced polymerization in aqueous silver salt solutions, 17: 27478
PROPENE, 2-METHYL-
radioinduced polymerization with tetrafluoroethylene, 17: 27476
PROPENE, 2-METHYL- POLYMERS
radiation effects on photoconductivity of, 17: 27893 (TID-18843)
PROPENE, PENTAFLUORO-
radioinduced polymerization, 17: 27433
PROPENE POLYMERS
radiation effects on physical properties of, 17: 27634(R) (NCSC-2477-4)
radioinduced crosslinking and degradation, 17: 27914
radioinduced peroxide radicals in, 17: 27450
PROPENE, TETRAFLUORO-
radioinduced polymerization, 17: 27433
PROPENEDIOL
protective effects of, against toxicity of 2,2'-dichloro-*N*-methyldiethylamine, 17: 27030
PROPIONALDEHYDE
formation by radiolysis of propenediol in air and nitrogen, 17: 27424
PROPORTIONAL DETECTORS
performance for time resolution of soft x rays, 17: 27709
PROPULSION
electric-nuclear, performance of dual system of, 17: 28575
ion, graphical method for optimization of cesium, 17: 27989
plasma properties in Kaufman-type ion motor, 17: 28360 (JPL-TR-32-417)
plasma, research on coaxial gun for, 17: 28362 (NP-12935)
PROTACTINIUM
separation from radioisotopes, uranium ores, and waste products, radiometric, 17: 27306
separation from thorium using liquid-metal extraction, 17: 28465 (TID-7650(p.436-53))
spectra at 0.8 to 3.0 microns, emission, 17: 28062
PROTEINS
chemical and radiation effects on synthesis of, in tumor cells, 17: 27035
metabolism of, effects of, on radiosensitivity of animals, 17: 27047
phosphorus-32 effects on synthesis of, in tadpoles, 17: 27072
radiation effects on composition of blood serum, effects of age, 17: 27171
radiation effects on effects of unknown agent on solutions of, gamma, 17: 27188
radiation effects on binding of chromium-51 by liver, 17: 27084
radiation effects on synthesis in *Bacterium cadaveris*, 17: 27109
radiation effects on cellular, 17: 27134
sorption from lungs, tracer study, 17: 27041
PROTON BEAMS
distribution in spherical water-filled phantom of 160-Mev, 17: 27059 (ORNL-3457)
PROTONS
density in ionosphere, 17: 28060
density of ≅40 kev, in outer magnetosphere, 17: 28123
emission in alpha reactions (α,p) with nuclei at 22 Mev, angular distributions for, 17: 28288
emission in photon reactions (γ,p) with antimony, copper, nickel, and tin at 24 Mev, yields for, 17: 28289
interactions at 8.35 Bev, distributions from elastic, 17: 28207
interactions with protons at 660 Mev, meson (π) production in, 17: 28140 (JINR-D-1236)
interactions with mesons (π^-), cross section and momentum spectrum for hyperon (Λ) production in, 17: 28144 (JINR-P-1245)
interactions with protons near 660 Mev, phase shift analysis of, 17: 28147 (JINR-P-1266)
interactions with mesons (π^0) at 600 Mev, branching ratios and cross sections for, 17: 28156 (UCRL-10563)
interactions with protons at 730 Mev, differential cross sections and polarizations for, 17: 28157 (UCRL-10637)
interactions with mesons (π^-) below 800 Mev, cross sections, Dalitz plots, and mass spectra for, 17: 28158 (UCRL-10720)
interactions with mesons (K^-) at 1.51 Bev/c, meson (ω) decay and production in, 17: 28159 (UCRL-10723)
interactions with mesons (π^-) at 7 Bev, inelastic two-prong, 17: 28171
interactions with mesons (π^-) at 6.8 Bev/c, inelastic, 17: 28205
interactions with photons at 181 Mev, mesons (π^0) from, 17: 28204
quantum transitions between spin-Zeeman levels of, 17: 28202
quantum transitions between spin-Zeeman levels of, perturbation theory

approximation for, 17: 28203
reactions on iron nuclei at 150 Mev, spallation cross sections in, 17: 28334
reactions (p,α) with silicon-30 at 1177–1509 kev, phosphorus-31 excited states from angular correlations and distributions from, 17: 28321
reactions (p,γ) with magnesium-24 at 1.49 Mev, aluminum-25 3.70-Mev level spin from, 17: 28266
reactions (p,γ) with oxygen-18 at 570–1500 kev, gamma angular distributions from, 17: 28290
reactions (p,γ) with aluminum-27 at 980–1030 kev, gamma spectra from 992-kev resonance in, 17: 28328
reactions (p,n), 17: 28247(R) (TID-18788)
reactions (p,n) with fluorine-19, energy levels of neon-19 excited in, 17: 28298
reactions with cesium iodide crystals, comparison with activator saturation model for scintillation efficiency from, 17: 27463
reactions with cesium iodide crystals; emission spectra and self-trapped holes in scintillation from, 17: 27464
reactions with helium and hydrogen at 100 kev, electron angular distribution and energy from, 17: 28048
reactors (p,2n), cross sections for, 17: 28247(R) (TID-18788)
scattering by carbon-12 at 182 Mev, impulse approximation calculations on, 17: 28300
scattering by complex nuclei at 27 Bev, angular distributions for mesons (π) from inelastic, 17: 28304
scattering by nuclei at 730 Mev, differential cross sections and polarizations for, 17: 28157 (UCRL-10637)
scattering on nuclei at 9–22 Mev, optical-model analysis of elastic, 17: 28316
scintillation response of liquid argon to, at 10 to 50 Mev, 17: 28059
yields in oxygen-16 reactions at 167 Mev, 17: 28252 (UCRL-10693)

PROTOTYPE ORGANIC POWER REACTOR
coolant properties of condensed polycyclic refinery product and terphenyl, 17: 27404 (NAA-SR-Memo-7426)

PROTOZOA
radiation effects on biological index in, cosmic, 17: 27196

PSYCHOLOGY
comfort factor survey for shelters, 17: 27611

PULSE ANALYZERS
design of multichannel kicksorter for two-dimensional sorting, engineering drawings for, 17: 27673
design of NIMROD injector beam monitoring system, 17: 27687 (NIRL/R/30)

PULSE COLUMNS
efficiency of intermittently pulsed liquid-liquid countercurrent, effects of phase transfer discontinuity on, 17: 27498

PULSE GENERATORS (ELECTRONICS)
circuit design of delay and square, for transparent beam-current monitors, 17: 27687 (NIRL/R/30)

PULSE TRANSFORMERS
design of toroidal, for transparent beam-current monitors, 17: 27687 (NIRL/R/30)

PUMPS
design of small-flow, 17: 27524(P)

PUPAE
radiation effects on, of fruit flies, 17: 27120

PYRIDINES
use in strontium-90 separation from yttrium-90, 17: 27447

PYRROLIDONE, VINYL-
radioinduced graft polymerization on polymethyl methacrylate, 17: 26944(R) (BMI-1630(Del.))

PYRROLIDONE, VINYL- POLYMERS
use of iodine-131-labeled, for tumor localization in man and rats, 17: 26992

Q

QUALITY CONTROL
procedures for, in fuel element manufacture, 17: 28432 (HW-SA-3045)

QUANTUM ELECTRODYNAMICS
vertex functions in, asymptotic values of relativistic, 17: 28216

QUANTUM MECHANICS
density matrix equations of motion in, perturbation solutions for, 17: 27991
dispersion relations in, integral representations of, 17: 28213
elementary particle models in, 17: 28206
functional method for condensed systems, 17: 28201
many-quantum transitions in two-phase systems, 17: 28202
non-conserving approximate solution of Schrödinger equation, method for reducing errors in, 17: 28242 (JINR-P-1259)
perturbation theory approximation for random perturbation times, 17: 28203
relativistic causality in, for scalar particles, 17: 28141 (JINR-E-1252)
spectral representations of inelastic amplitudes in, 17: 28209
wave functions in, tensor virial theorems for variational, 17: 28050

QUARTZ
development of high pulse height phosphors of, effects of arsenic and cerium oxides on, 17: 27701
radioinduced stresses in, from fission fragment bombardment, 17: 27888 (BMI-1635)
thermal conductivity of powdered, 17: 27368

QUINONES
2,5-bis(ethyleneimino)-3,6-bispropoxy-1,4-benzo-, mechanism of effects of, on tumor cells, 17: 27035

R

RABBITS
monitoring for beta activities in, at Nevada Test Site after reactor test (Kiwi-A), 17: 27054 (TID-18864)
radiation effects on erythrocytes in, 17: 27166
radiation effects on abdomen and head, irritating, 17: 27070(T) (JPRS-19806)
radiation effects on elastic fibers in ears of, 17: 27133

RADIATION
avoidance, effects of ozone in mice, 17: 27175
biochemical effects on cellular proteins, 17: 27134
biological effects on man, 17: 27151
biological effects on blood coagulation, 17: 27202
biological effects of, review of, 17: 27058 (NP-12897)
biological effects on mouse fetuses, 17: 27106
chromosome aberrations in regenerating liver induced by single or chronic exposure, 17: 27176
control in Massachusetts industry, medical, 17: 27615
detection and measurement of biologically effective dose, design of ionization chamber for, 17: 27056 (CERN-63-17)
detection and measurement of, design of iron-shielded room for, 17: 27516
dosimetric units, 1962 ICRU report on, 17: 26956
dosimetry of, review of, 17: 27058 (NP-12897)
effects in agricultural plants and animals, bibliography, 17: 27635 (NP-12928)
effects in agricultural plants and animals, bibliography, 17: 27636 (NP-12929)
effects in mammals, genetic, 17: 27090
effects of unknown agent of, on sedimentation rate of erythrocytes in human blood, 17: 27128
effects of unknown agent on erythrocyte sedimentation rate in human blood, effects of lead shielding on, 17: 27129
effects on animal cells, time-intensity factors in, 17: 27144
effects on biological systems, nature of, 17: 27131
effects on cells, role of metabolism and mitosis in, 17: 27108
effects on cellulose, hemicellulose, lignin, and pectin in plants, 17: 27088
effects on leukemia incidence in man, 17: 27210
effects on mammals, late pathological, 17: 27146
effects on man, chronic internal, 17: 27150
effects on man, genetic and physiological, 17: 27210
effects on molecules of invertase, 17: 27114
genetic effects in agricultural plants and animals, 17: 27636 (NP-12929)
genetic effects in mice, 17: 27098
genetic effects in agricultural plants and animals, 17: 27635 (NP-12928)
hazards in treatment of skin diseases using radium-224, 17: 27608
hazards in uranium milling and mining, 17: 27617

industrial uses of, 17: 27641
lethal effects on mice, protective effects of Librium against, 17: 27189
population exposure from natural sources in New England, 17: 27629
quantities and units of, ICRU recommendations on, 17: 27625
RADIATION CHEMISTRY
bibliography on chemical effects of nuclear transformations, 17: 27421 (NP-12894)
effects of unknown x-agent on color of methyl red and phenolphthalein solutions, 17: 27452
reaction mechanisms, role of competitive scavenger, 17: 27177
RADIATION DETECTION INSTRUMENTS
development at Ispra for health physics measurements, 17: 27682 (EUR-14.i)
performance of whole-body, review on, 17: 27691
RADIATION DETECTION INSTRUMENTS (COLORIMETRIC)
performance evaluation of glass fluorod dosimeters, 17: 27683 (HW-66728)
reader design for glass dosimeters, 17: 27710(P)
RADIATION DETECTION INSTRUMENTS (ION CURRENT TYPE)
design for high-level in-cell gamma monitoring, 17: 27684 (HW-67376)
RADIATION DETECTION INSTRUMENTS (PULSE TYPE)
data handling from automatic liquid scintillation counter, computer program for, 17: 27274
design and characteristics of alpha pulse chamber, 17: 27693
design and characteristics of spark chamber, 17: 27700
design for low-level in-cell beta and gamma monitoring, 17: 27684 (HW-67376)
design of point air-flow, for exo-electrons, 17: 27688
use for selective detection of copper K-α radiation, 17: 27708
RADIATION INJURIES
book: *Fundamental Processes of Radiation Injuries*, 17: 27195
book: *Ionizing Radiation and Metabolism*, 17: 27192
book: *Irradiation and the Nervous System*, 17: 27194
book: *Problems of Ionizing Radiation Effects on the Nervous System*, 17: 27193
cellular, role of DNA in, 17: 27107
development of radiation proctitis after radiotherapy of uterine cervical carcinoma, delayed, 17: 27183
effects on fibrinolytic activity in dogs, 17: 27212
in bone from internally deposited strontium-89, 17: 27149
of algae, restoration by interaction, 17: 27095
of alimentary tract, 17: 27211
of bone marrow, effects of treatment with cell-free spleen extract, 17: 27073
of cells in mitosis, 17: 27152
of fetuses from exposure of pregnant mice, 17: 27106
of intestine, pathology, 17: 27205
of skin, treatment, 17: 27104
protection against, using ethyl stearate, 17: 27156
protection against, hematology in, 17: 27161
protective effect of acidophilus milk, 17: 27082
protective effects of acidophilus milk, 17: 27083
therapy with injected bone marrow, genetic factors in, 17: 27206
therapy with injected bone marrow, genetic factors in, 17: 27207
to rats, effects of dose rates on, 17: 27143
treatment with bone marrow or lymph node cells, immune reactions, 17: 26971
RADIATION PROTECTION
concepts and status of, 17: 27631
developments in medicine, 17: 27626
equipment and techniques for, review of, 17: 27624
in agricultural research, 17: 27627
in refabrication of thorium–uranium-233 fuels, 17: 28460 (TID-7650 (p.253-84))
of man during space flight, 17: 27115
public health responsibilities in, 17: 27630
quantities and units of, ICRU recommendations on, 17: 27625
regulations of New York State, 17: 27597 (NP-12924)
review, 17: 27058 (NP-12897)
RADIATION SICKNESS
effects on blood coagulation, 17: 27202
protection against, using Librium, 17: 27189
RADIATION SOURCES
characteristics of available, 17: 26962
RADIATION TARGET CANS
burnup testing of stainless steel, containing uranium dioxide, 17: 28429(R) (GEAP-3771-5)
design and operation of superheat strain-cycle, for evaluation of fuel element cladding, 17: 28430 (GEAP-3933)
RADIATION TARGETS
characteristics of available, 17: 26962
RADIATORS
fluid flow distribution and losses in header-tube configurations in, for space applications, 17: 28574(R) (PWA-2197)
RADICALS
formation and observation of μ^+ mesic organic, 17: 28342
RADIO WAVES
absorption in ionosphere, electron density profiles from, 17: 28018
effects of nuclear explosions on very-low-frequency propagation, 17: 26954
emission from sun, high-resolution study of 3–21 cm, 17: 28110
emission in Milky Way galaxy, disk component of, 17: 28107
emission of 610-Mc, from Jupiter, 17: 28114
transmission through atmosphere and ionosphere, bibliography on, 17: 27937 (AID-62-155)
RADIOACTIVE GAS SEPARATION PROCESSES
design for reactors, 17: 28517(P)
RADIOACTIVE MATERIALS
handling of, survey of accidents in, 17: 27618
shipping by truck, control of risks in, 17: 27599 (NYO-9773)
RADIOACTIVITY
in clays in oil well section in Crimea and Eastern Caucasus Foreland, 17: 27572
measurement in atmosphere over Mexico City by lead-212 content, 17: 27628
measurement of natural, in Paris, France, 17: 27567
monitoring atmospheric, at Sljeme and Zagreb, Yugoslavia, Feb. to May 1962, 17: 27569
RADIOAUTOGRAPHY
destaining stripping-film using trypsin, 17: 26988
preparation of standard slides for, 17: 27010
RADIOBIOLOGY
book: *Ionizing Radiation and Metabolism*, 17: 27192
concepts of, 17: 26989
contamination of laboratories, 17: 27614
genetic effects of radiation, review, 17: 27159
laboratory experiments in, manual for college and advanced high school students, 17: 27061 (TID-18616)
radiation depth dose tables and isodose charts for medium energy x rays, 17: 27633
review, 17: 27058 (NP-12897)
RADIOCHEMICAL PROCESSING PLANTS
analytical procedures for, 17: 27231(R) (IDO-14605)
criticality control using boron, 17: 27502
design concepts for Thorium Fuel Cycle Development Facility, 17: 28462 (TID-7650(p.333-50))
design of, for recycle of thorium–uranium power reactor fuel, 17: 28461 (TID-7650(p.285-332))
design of Kilorod Facility at ORNL, 17: 28463 (TID-7650(p.351-83))
equipment for remote refabrication of thorium oxide-uranium oxide fuel in PCUT, 17: 28471 (TID-7650(p.553-84))
RADIOCHEMISTRY
developments of, at Idaho Chemical Processing Plant, 17: 27231(R) (IDO-14605)
RADIODERMATITIS
therapy, 17: 27104
RADIODIAGNOSIS
bibliography, 17: 27067 (WP/22/5)
of bone metastases from breast cancer, 17: 27019
of cervical cancer, 17: 26968
of chest, modification of film size for, 17: 27610
of gastrointestinal tract, 17: 26986
use of reactors, review, 17: 27162
RADIOGRAPHY

pathological effects of thorium oxide and zirconium oxide contrast mediums, 17: 26972
RADIOISOTOPES
atmospheric, sampler for collection of aerosols of, 17: 27580
book: *Radioactive Isotopes in Nature*, 17: 27584
book: *Use of Radioactive Isotopes in Engineering Studies*, 17: 27583
catalog, ORNL, 17: 26961
characteristics of available, 17: 26962
deposition in man, diagnosis and treatment of, 17: 27208
handling and storage of, safety measures in agriculture research for, 17: 27627
handling of, survey of accidents in, 17: 27618
industrial uses of, 17: 27641
shipping requirements for, 17: 27586 (AHSB(RP)R-23)
spectra in textiles, gamma, 17: 27634(R) (NCSC-2477-4)
theoretical aspects of studies on, 17: 26955
urinary excretion of, use of chelating agents for acceleration of, 17: 27024
use in agricultural studies, review, 17: 27092
uses in biology and medicine, review, 17: 27005
RADIOLOGICAL DEFENSE
restoration of metropolitan water works following nuclear attack, 17: 27595 (NP-12902)
RADIOLOGY
medical, developments in, 17: 27626
RADIOMIMETIC SUBSTANCES
effects of irradiated foods on *E. coli*, 17: 27027
RADIOSENSITIVITY
effects of thyroid function, in mice, 17: 27173
of albino mice of pure strains, 17: 27182
of amino acids in proteinase, 17: 27429
of animals, effects of metabolism on, 17: 27047
of bone marrow and eye lens, 17: 27139
of cells in tissue culture, effects of 5-bromodesoxyuridine, 17: 27093
of chromosomes in different phases of mitosis, 17: 27168
of embryos, effects of age of mother in mice, 17: 27169
of mammary tumor cells in mice, effects of membrane system and mitochondria on, 17: 27135
of mitosis in rapidly dividing rat cells, 17: 27138
of mouse and rat cells, molecular nature of, 17: 27140
of plants, effect of chromosome size, 17: 27153
of rats, effects of steroid hormones on, 17: 27209
of rats, effects of DNA content in liver on, 17: 27141
of tumor cells, effects of immune reactions on, 17: 27142
RADIOSTERILIZATION
of diet for rearing germ-free guinea pigs, 17: 27004
of foods, method and uses of, 17: 27011
of fruits and vegetables, effects of, on storage, 17: 27096
prevention of off-flavors in beef from, process for, 17: 27648(P)
review on, 17: 27926
RADIOTHERAPY
bibliography, 17: 27067 (WP/22/5)
design of cobalt-60 unit with shutter-type filter for, 17: 27008
developments in techniques for, of malignant disease, 17: 26989
dosage determinations for skin tumor exposure in, 17: 27009
effect of pelvic, on small intestine, 17: 27078
effects of irradiation of gonads in treatment of breast cancer, 17: 27075
of bronchial carcinoma following pneumonectomy, effectiveness of, 17: 27007
of cancer of breast, effectiveness of, 17: 27006
of cervical carcinoma using telecobalt, percutaneous, 17: 26976
of gynecologic cancer, review on history of, 17: 27012
of hemangioma, development of carcinoma from, 17: 27130
of hemangiomas, design of soft x-ray tube for, 17: 26991
of hyperthyroidism, dose calculation for iodine-131, 17: 26965
of neoplasms by combination with chemotherapy, 17: 26990
of ovaries and tonsils, evaluation of supervoltage, 17: 26973
of pituitary gland tumor by implanted yttrium-90, 17: 27191
of rheumatoid arthritis, development of leukemia from, 17: 27167
of thyroid tumors, dosimetry of, 17: 26966
of tumors, 17: 26964(R) (ORINS-42)
of tumors, effects of fractionation and protraction of doses on, 17: 27145
performance of Mev-range x-ray, for cancers, 17: 27000
radio-proctitis from uterine carcinoma, 17: 27183
supervoltage, advantages of, over orthovoltage, 17: 27003
use of reactors, review, 17: 27162
RADIOTOXICITY
of radioisotopes, classification for packaging and shipping, 17: 27586 (AHSB(RP)R-23)
RADIUM
radiation damage by, of intestinal tract, 17: 27078
RADIUM ISOTOPES Ra-224
determination in samples of bone and teeth, radiochemical, 17: 27172
treatment of skin diseases using, radiation hazards in, 17: 27608
RADIUM ISOTOPES Ra-226
content in patients at Luchon, France, gamma spectra of, 17: 27042
determination in bone ashes, radiometric, 17: 27285
determination in bone, 17: 27051
determination in diet, 17: 27051
determination in samples of bone and teeth, radiochemical, 17: 27172
ingestion and inhalation by humans, long-term effects of, 17: 27150
RADIUM ISOTOPES Ra-228
ingestion and inhalation by humans, long-term effects of, 17: 27150
separation of daughters from, by paper electrophoresis in high electric fields, 17: 27445
RADON FLUORIDES
preparation and properties of di-, 17: 27327
RAIN WATER
analysis for tritium, benzene method for, 17: 27292
RARE EARTH BORATES
crystal structure, 17: 27837
RARE EARTH CHELATES
pathological effects of injected, in liver, 17: 26964(R) (ORINS-42)
RARE EARTH OXIDES
spectra of, infrared absorption, 17: 27840
RARE EARTH VANADATES
preparation and diffraction patterns, 17: 27217
RARE EARTHS
analysis for europium, spot test for qualitative, 17: 27300
book: *Effects of Impurities and Rare Earth Elements on Properties of Alloys*, 17: 27881
book: *Separation of Similar Rare Metals*, 17: 27401
partition coefficients and reciprocal ionic radii, 17: 27562 (INSJ-54)
separation from fused nitrates by ion exchange, 17: 27500
separation from scandium by solvent extraction, 17: 27369
separation from thorium using liquid-metal extraction, 17: 28465 (TID-7650(p.436-53))
RARE GASES
diffusion from irradiated uranium dioxide, kinetics of, 17: 27886 (AERE-M-969)
performance in thermionic cells, 17: 27981
radioinduced luminescence of, in an electric field, 17: 28011
RATE METERS
evaluation of neutron-survey, 17: 27685 (LA-2860)
reader design for glass dosimeters, 17: 27710(P)
RATS
barium and strontium metabolism, 17: 27029
calcium-45 and strontium-85 uptake by bones in, effects of fluoridated water on, 17: 27044
cesium metabolism in fetuses of, 17: 27036
morphological responses of, to foreign particles intravenously injected, 17: 26967
radiation effects of internally deposited strontium-89 on bones in, 17: 27149
radiation effects on reproduction in successive litters, chronic exposure, 17: 27170
radiation effects on tumor development in, partial- and whole-body, 17: 27094
radiation effects on spleen and testes of, pre-exposed to low doses, 17: 27137
radiation effects on bones and eye lens of, 17: 27139
radiation effects on cellular constituents of bone marrow and intestine in, late, 17: 27147
radiation injuries to, effects of dose rates on, 17: 27143

radiosensitivity of, effects of steroid hormones on, 17: 27209
radiosensitivity of cells in, molecular nature of, 17: 27140
radiosensitivity of, effects of DNA content in liver on, 17: 27141
toxic effects of acetic acid chelates on, 17: 27026
tumor localization in, use of iodine-131-labeled compounds for, 17: 26992
uptake and retention of uranyl nitrate by kidneys in, effects of chelating agents on, 17: 27025

REACTION MECHANISMS
kinetics in jet propulsion gases and plasmas, 17: 27538(R) (NP-12767)
tracer techniques for study of, review, 17: 27330

REACTOR CONTROL ELEMENTS
neutron absorption and self shielding by, computer program for calculating, 17: 28440 (KAPL-M-RPC-8)
worth calculations, linear extrapolation distance for, 17: 28235

REACTOR CONTROL RODS
design of cable winding mechanism, 17: 28513(P)
drive unit installation in wall, design of mechanical joint for, 17: 28516(P)
handling apparatus for, design of, 17: 28504(P)
neutron flux boundary conditions at surface of hollow, 17: 28491
position indicator for, 17: 27676(P)

REACTOR CONTROL SYSTEMS
concept of discontinuous, for boiling reactors, 17: 28540

REACTOR COOLANTS
development of organic, 17: 28433(R) (IDO-11005)
hydrocracking of organic, evaluation of catalysts for, 17: 28434 (IDO-16858)
processing by hydrocracking high boilers, 17: 28435 (IDO-16877)
processing for radioactive gas separation, 17: 28517(P)
properties of condensed polycyclic and terphenyl, 17: 27404 (NAA-SR-Memo-7426)
purification by ion exchange, effects of boric acid and potassium hydroxide on, 17: 27493 (WCAP-3716)
purification of gaseous, by electrostatic techniques, 17: 28484 (TID-18911)
radiation effects on organic, under in-pile conditions at 600°F, 17: 28441(R) (MITNE-29)
radiolysis studies of organic, 17: 27423(R) (TID-18195)
use of boron as neutron absorber in, 17: 27813 (WCAP-3713)

REACTOR COOLING SYSTEMS
containment, enclosure design for, 17: 28556(P)
containment of conduit, enclosure for, 17: 28557(P)
fission product detection in, system for, 17: 28515(P)

REACTOR ENGINEERING
book: *Nuclear Fuel Handling*, 17: 28501

REACTOR FUEL ALLOYS
analysis for uranium, photometric, 17: 27269
analysis of fissium–uranium, for molybdenum, palladium, rhodium, ruthenium, and zirconium, 17: 27255
fabrication of aluminum–plutonium, by pneumatic injection casting, 17: 27758 (HW-69204)
metallography of molybdenum–uranium, 17: 27790 (NAA-SR-Memo-8408)

REACTOR FUEL ELEMENTS
analysis for uranium-235, nondestructive method for, 17: 27229 (EUR-248.f)
burnup testing of stainless steel-clad uranium dioxide, 17: 28429(R) (GEAP-3771-5)
cladding of, design and operation of superheat strain-cycle capsule for evaluation of, 17: 28430 (GEAP-3933)
decanning, machine for, 17: 27525(P)
design for interconnections, 17: 28503(P)
design of tubular rod assembly, 17: 28509(P)
design of 19-rod bundle for burnout heat flux testing, 17: 28422(R) (DPST-63-69-3)
development and fabrication of Zircaloy-2-clad uranium dioxide, 17: 28526(R) (DP-845)
fabrication of thorium, design of facility for, 17: 28463 (TID-7650 (p.351-83))
handling apparatus for, design of, 17: 28504(P)
heat transfer burnout of 7-rod bundle, effects of rod spacing on, 17: 28423(R) (DPST-63-69-6)
heat transfer in, maximum internal, 17: 27551
heat transfer in 19-rod bundles, 17: 28533(R) (SRO-83)
manufacture of, quality control procedures in, 17: 28432 (HW-SA-3045)
neutron thermal utilization factor for, determination from extrapolation lengths, 17: 28230
processing of irradiated thorium–uranium, design of plant for, 17: 28461 (TID-7650(p.285-332))
processing of irradiated thorium design of facility for, 17: 28462 (TID-7650(p.333-50))
processing of irradiated thorium, 17: 28464 (TID-7650(p.384-435))
processing of spent, development of electrochemical equipment for, 17: 27653 (IDO-16852)
surface temperature monitoring during irradiation, development of instrumentation for, 17: 27652 (HW-SA-3036)
temperature distribution in, during reactor power transients, 17: 28438 (KAPL-M-BEE-1)
transport methods for irradiated, to radiochemical processing plants, 17: 28562 (EUR-185.f,d,e)

REACTOR FUEL ELEMENTS (CERAMIC)
conference minutes on, 17: 27734 (TID-7666)
design, 17: 28511(P)
development of coated particles for, 17: 26944(R) (BMI-1630(Del.))
fission gas release from irradiated coated-particle, 17: 26944(R) (BMI-1630(Del.))
properties of uranium dioxide, 17: 27737
reprocessing and fabrication of irradiated uranium dioxide pellets, simulation studies of, 17: 27764

REACTOR FUEL ELEMENTS (DISPERSION)
development of beryllia and graphite matrices of coated fuel particles as, 17: 26944(R) (BMI-1630(Del.))
performance of stainless steel–uranium dioxide, 17: 27863

REACTOR FUEL RODS
fabrication from dense sintered uranium dioxide by extrusion, 17: 27762(T-R) (EURAEC-368)
fabrication of uranium dioxide, by gas-pressure bonding, 17: 26944(R) (BMI-1630(Del.))
fission gas pressure measurements in operating, development of instrument for, 17: 27651 (GEAP-4135)
shock absorber for, 17: 28505(P)

REACTOR FUEL SPHERES
structure of carbon-coated uranium carbide, 17: 27796 (ORNL-TM-521)

REACTOR FUEL TAPES
analysis for total uranium content, method for, 17: 27291

REACTOR FUEL TUBES
development and fabrication of Zircaloy-2-clad coextruded uranium, 17: 28526(R) (DP-845)

REACTOR FUELS
development of thorium, 17: 28448 (TID-7650(p.1-18))
diffusion into refractory metals, 17: 27961
economic aspects of thorium, 17: 28479 (TID-7650(p.721-37))
processing of, criticality control in, 17: 27502
properties of plutonium-containing, 17: 27738
radiation hazards in refabrication of thorium–uranium-233, 17: 28460 (TID-7650(p.253-84))
shipment of spent domestic and foreign, to reprocessing plant in USA, economic analysis of, 17: 28446 (ORNL-TM-590)

REACTOR FUELS (FUSED SALTS)
properties of plutonium and uranium chlorides as, for use in fast breeder reactors, 17: 27797 (PAN-414/V)

REACTOR MATERIALS
deformation and fabrication properties, 17: 27783(R) (GA-4227)
evaluation of alloys for use as, 17: 27730(R) (HW-77052)
testing in aqueous slurries and solutions at high temperatures, design of out-of-pile pump loop for, 17: 27507 (ORNL-3449)

REACTOR MATRICES
buckling and void effects in heavy-water-moderated organic- or light-water-cooled uranium dioxide, 17: 28483 (TID-18895)
buckling and voiding in heavy-water-moderated, of uranium dioxide tube clusters, 17: 28526(R) (DP-845)
criticality studies of water-moderated thorium dioxide-uranium dioxide, 17: 28452 (TID-7650(p.76-87))
criticality studies of thorium-uranium-233 epithermal systems, 17: 28453 (TID-7650(p.88-127))

lattice design for heterogenous reactors, 17: 28520(P)
neutron absorption by uranium-238 dioxide in, thermal activation method for measuring, 17: 28419 (BAW-1268)
neutron spectra in, 17: 28437 (KAPL-2000-20)
REACTOR MODERATORS
structures for, design of stable, 17: 28519(P)
REACTOR SAFETY
containment and site selection, review of principles determining, 17: 28487
hazards summary for University of Cincinnati Research Reactor, 17: 28566 (NP-12915)
program of EURATOM dosimetry working group, 17: 27590 (EUR-88.f)
REACTOR SAFETY EXPERIMENTS
development and operation of SPERT I, II, and IV, 17: 28436(R) (IDO-16890)
development of power excursion reactor at Ispra, 17: 28563 (EUR-271.1)
SPERT-I capsule experiment, engineering drawings for, 17: 28502
REACTOR SHIELDING
design and evaluation for ORGEL critical experiment, 17: 28428 (EUR-149.f)
design for ship propulsion reactors, 17: 28559(P)
REACTOR TUBES
creep properties of Zircaloy-2 pressure, 17: 27822
testing, 17: 27730(R) (HW-77052)
REACTORS
conference on thorium fuel cycle, Gatlinburg, Tenn., Dec. 5 to 7, 1962, 17: 28447 (TID-7650)
criticality and disadvantage factors for, 17: 28437 (KAPL-2000-20)
criticality calculations for one-dimensional multiregion, 17: 28495
criticality calculation for multiregion, 17: 28494
criticality changes in, due to neutron scattering cross section changes, 17: 28437 (KAPL-2000-20)
criticality studies of thorium-fueled, 17: 28451 (TID-7650(p.57-75))
development of thorium fuel cycle program for, 17: 28448 (TID-7650 (p.1-18))
dynamic beahvior of, determination of, from white noise, 17: 28486
economic aspects of thorium-fueled, 17: 28480 (TID-7650(p.738-61))
fuel element temperature lags during power transients in, 17: 28438 (KAPL-M-BEE-1)
kinetics of reflector-perturbed, 17: 28436(R) (IDO-16890)
kinetics of, variational method for nonlinear problems of, 17: 28437 (KAPL-2000-20)
loading and unloading, book on, 17: 28501
loading equipment for, 17: 28504(P)
medical uses, 17: 27162
neutron diffusion in, flux linear relation to adjoint functions in two-group, 17: 28233
neutron distributions in, computer program for calculating low-energy, 17: 28222 (KAPL-M-RPC-1(Rev.1))
neutron flux distributions in, methods of calculating and measuring, 17: 28492
physics of thorium-uranium-233 epithermal systems in, 17: 28453 (TID-7650(p.88-127))
poisoning by xenon, for equilibrium conditions, 17: 28425 (EUR-102.f)
reactivity measurement in highly subcritical range by digital cross-correlation technique, 17: 28444 (NP-12910)
reactivity measurement in sub-critical, method using sinusoidal source modulation for, 17: 28489
reactivity of, review of methods for describing time-dependent, 17: 28485 (WAPD-T-1376)
reactivity variation for different fuel cycles, long-term, 17: 28426 (EUR-129.f)
xenon stability in slab, two-group analysis of, 17: 28416 (AE-108)
REFRACTORY MATERIALS
bibliography on properties of carbide, 17: 27809 (UCRL-7284)
brazing, exothermic, 17: 27760(R) (NP-12901)
equilibrium diagrams of metal oxide systems, 17: 27788(R) (LRR-41)
fabrication by slip casting, development of techniques for, 17: 27807(R) (TID-18891)
reactor fuel diffusion into, 17: 27961
sorptive properties for cesium, 17: 27970
synthesis of organic tin-aluminum polymers, 17: 27221(P)
thermodynamic properties of, bibliography on, 17: 27793 (NP-12938)
REFRIGERANTS
handling cryogenic, hazards of, 17: 28081
REFRIGERATION
design for liquid helium, for 20 and 4.2°K, 17: 28078
design of helium closed-cycle cascade system for, at 4.4°K, 17: 28079
design of helium closed-cycle system for, at 2.5°K, 17: 28080
RELATIVITY THEORY
gravitational central-symmetric fields in, 17: 28064
REMOTE-CONTROL EQUIPMENT
design of specimen cutting machine for use in hot cells, engineering drawings for, 17: 27521
design of transfer mechanisms for high-level radiochemistry cells, engineering drawings for, 17: 27519
mounting through walls, arrangement for frictionless, 17: 27522(P)
REMOTE-VIEWING EQUIPMENT
design for viewing of slave portion of manipulator, 17: 27527(P)
RESEARCH REACTORS
design for producing short-lived radioisotopes, 17: 28571(P)
fuel shipping methods for, 17: 28562 (EUR-185.f,d,e)
hazards summary for University of Cincinnati, 17: 28566 (NP-12915)
safety, program of EURATOM dosimetry working group, 17: 27590 (EUR-88.f)
use for activation analysis, 17: 27241 (TID-18908)
RESERPINE
protective effects of, against toxicity of 2,2'-dichloro-*N*-methyldiethylamine, 17: 27030
RESPIRATORY TRACTS
radiation effects on freshly sutured bronchial stumps and esophageal anastomoses, 17: 27127
RETICULO-ENDOTHELIAL SYSTEM
morphological responses to foreign particles, 17: 26967
RHENIUM
cesium migration on, cyclic and spontaneous, 17: 27971
separation of iridium-186 and -188 from alpha-irradiated, by electrolysis, 17: 27459
use for geologic age determinations, 17: 27566(T) (AEC-tr-5858)
work function, 17: 27970
RHENIUM ALLOYS
Nb–Re, rolling of, 17: 27733(R) (NMI-2116)
Re–W, fabrication techniques for tubing of, 17: 27733(R) (NMI-2116)
RHENIUM SILICIDES
electron structure and physical properties of crystals of, 17: 27875
RHENIUM SYSTEMS
Re–UC, properties as thermionic cell emitters, 17: 27962
RHODIUM
determination in fissium–uranium alloys, fluorescent x-ray spectrometric, 17: 27255
determination in rhodium–uranium alloys, gravimetric, 17: 27259
gamma reactions at 1–2 Mev, electron pair cross section Z-dependence from, 17: 28275
RHODIUM ALLOYS
Pt–Rh, beta sorption as function of atomic number, 17: 28184
Rh–U, analysis for rhodium, 17: 27259
RHODIUM ISOTOPES Rh-103
proton reactions (p,n) with, excitation function and recoil behavior for, 17: 28247(R) (TID-18788)
RHODIUM ISOTOPES Rh-106
content in vegetation in Northern Alaska from fallout, 17: 27053 (HW-SA-3050)
RHODIUM ISOTOPES Rh-111
decay of, branching ratio to palladium-111 and 111m, 17: 28280
RHODIUM SYSTEMS
Rh–Te, structure and superconductivity in, 17: 27816(T) (UCRL-Trans-921)
RIBONUCLEIC ACID
effects on radiosensitivity of cells in tissue culture, 17: 27060 (SAM-TDR-63-17)
phosphorus-32 effects on, in tadpoles, 17: 27072
synthesis in regenerating liver, tracer study, 17: 26970
RIBONUCLEIC ACID, DESOXY-
chemical and radiation effects on synthesis of, in tumor cells, 17: 27035

content in liver cells, effects on radiosensitivity of rats, 17: 27141
effects on radiation injury in cells, 17: 27107
phosphorus-32 effects on, in tadpoles, 17: 27072
radiation effects on, in *Escherichia freundii* in culture, 17: 27113
radiation effects on synthesis of, in mouse and rat liver, 17: 27140
synthesis, tracer study, 17: 26982
ultraviolet radiation effects on primer activity, 17: 27080
RIBOSE, DEOXY-
urinary excretion in rats, effects of methionine and x radiation sulfoximine, 17: 27037
ROCKET MOTORS
electric-nuclear, performance of dual system of, 17: 28575
ion, graphical method for optimization of cesium, 17: 27989
ROCKET REACTORS
design, 17: 28576
ROCKET REACTORS (KIWI)
gamma and neutron flux measurements for, B-4A, 17: 28572 (LA-2885)
ROCKETS
power supply for, design of simplified radioactive, 17: 28578(P)
ROCKS
analysis for thorium in Decca Traps, spectroscopic, 17: 27571
analysis for thorium, evaluation of reagents for, 17: 27246
radioactivity in sedimentary, in gas and oil fields in Japan, 17: 27579
strontium-87–strontium-86 ratios in 45, as an index of geologic processes, 17: 27582
RODENTS
monitoring for beta activities in, at Nevada Test Site after reactor test (Kiwi-A), 17: 27054 (TID-18864)
ROLLING
research programs for aircraft materials, 17: 27759 (MAB-139-M(R3))
ROOTS
radiation effects on growth of, 17: 27068(T) (CEA-tr-R-1678)
radiation effects on chromosomes in *Avena sterilis*, 17: 27087
ROTARY PUMPS
performance of inducer-impeller combination in liquid hydrogen, 17: 28093
ROTARY SEALS
design for centering and sealing shaft through wall, 17: 27523(P)
RUBBER
radiation effects on mechanical properties of, 17: 27915
radioinduced vulcanization of natural and synthetic, effects of, on properties, 17: 27934
reinforcement by irradiated carbon black, 17: 27649(P)
polyethylene–rubber, radiation effects on structure of, 17: 27931
RUBIDIUM
partition coefficients and reciprocal ionic radii, 17: 27562 (INSJ-54)
separation from alkali metal chlorides and chloroplatinates, method for, 17: 27243(T) (AEC-tr-5822)
thermophysical properties of, 17: 27535 (BNL-801)
RUBIDIUM AZIDES
radiation effects on photoelectric properties of, 17: 27468
RUBIDIUM BROMIDE CRYSTALS
spectra of, F-center positions in, 17: 27377
RUBIDIUM BROMIDES
spectra of F centers in, 17: 27395
RUBIDIUM CHLORIDES
spectra of F centers in, 17: 27395
RUTHENIUM
book: *Ruthenium and Osmium, Bibliographic Guide to Literature (1804–1960)*, 17: 27400
determination in fissium–uranium alloys, fluorescent x-ray spectrometric, 17: 27255
determination using thiocyanate, spectrophotometric, 17: 27287
separation from acid solution by solvent extraction using thiocyanate, 17: 27460
RUTHENIUM ALLOYS
Ru–Ta, cold rolling schedules and tensile properties for, 17: 27733(R) (NMI-2116)
RUTHENIUM ISOTOPES Ru-103
content in children and stillborn infants, 17: 27013 (TID-18878)
determination in acid solutions, absorptiometric, 17: 27224(AERE-AM-68)
RUTHENIUM ISOTOPES Ru-106
content in children and stillborn infants, 17: 27013 (TID-18878)
content in vegetation in Northern Alaska from fallout, 17: 27053 (HW-SA-3050)
determination in acid solutions, absorptiometric, 17: 27224 (AERE-AM-68)

S

SAFETY
accidents in handling radioactive materials, survey of, 17: 27618
analysis of methods for transporting research reactor fuel elements to radiochemical processing plants, 17: 28562 (EUR-185.f,d,e)
in shipping of radioactive materials by truck, economical control of risks in, 17: 27599 (NYO-9773)
radiation hazards in use of promethium-147-activated luminous paints, 17: 27619
SAFETY HAZARDS
analyses during abort and re-entry of SNAP-10A, testing program for, 17: 28573 (NAA-SR-8304)
SALICYLIC ACID
3-oximinomethyl-, analytical use for thorium, 17: 27263
SALTS
metal ion sequestration in aqueous solutions of, tracer studies of, 17: 27320(R) (ORO-602)
SAMARIUM
partition coefficients and reciprocal ionic radii, 17: 27562 (INSJ-54)
spectra in alkali-halide single crystals, absorption and luminescence, 17: 27372(T)
SAMARIUM BORATES
crystal structure, 17: 27837
SAMARIUM BORIDES
electron structure and physical properties of crystals of, 17: 27875
SAMARIUM ISOTOPES Sm-149
neutron capture by, conversion electron and gamma spectra for thermal, 17: 28305
SAMARIUM ISOTOPES Sm-150
energy levels and gamma transitions for, 17: 28305
SAMARIUM OXIDES
spectra of, infrared absorption, 17: 27840
SANDIA CORP., ALBUQUERQUE, N. MEX
bibliography of civilian application releases through 1962, 17: 26947 (SCR-600)
SAP (SINTERED ALUMINUM PRODUCTS)
analysis for impurities, x-ray spectrographic, 17: 27226 (EUR-21.f)
analysis for impurities, spectrographic, 17: 27271
creep-rupture properties, 17: 26944(R) (BMI-1630(Del.))
creep-rupture properties of M-257, M-583, and 895, at 800 and 900°F, 17: 28533(R) (SRO-83)
fabrication and properties of Frittoxal, 17: 27757 (EUR-273.f)
SARCOMAS
development in thyroid gland, following x irradiation, 17: 27184
radiotherapy of, using Mev-range x radiation, 17: 27000
therapy of nonresectable abdominal lympho-, occurrence of acute radiation nephritis in, 17: 27203
thorium dioxide effects on development, of hemangioendothelial, in liver in man, 17: 27190
thorium dioxide effects on development of, in liver in man, 17: 27081
SATELLITES
meteorological observations by, conference on, 17: 27563 (NP-12932)
SAVANNAH RIVER COMPONENTS TEST REACTOR
operation, 17: 28526(R) (DP-845)
operation, May 1963, 17: 28533(R) (SRO-83)
SCALERS
description of fast, 17: 27660
SCANDIUM
partition coefficients and reciprocal ionic radii, 17: 27562 (INSJ-54)
separation from rare earths and yttrium by solvent extraction, 17: 27369
SCANDIUM ALLOYS
Sc–Y, phase studies, 17: 27785 (IS-569)
Sc–Zy, phase studies, 17: 27785 (IS-569)
SCANDIUM ISOTOPES Sc-44
energy levels, 17: 28249 (UCOL-P-518)

SCANDIUM ISOTOPES Sc-45
alpha reactions (α,p) at 22 Mev, angular distributions from, 17: 28288
proton reactions (p,n) with, excitation function for, 17: 28247(R) (TID-18788)
SCANDIUM ISOTOPES Sc-46
decay of, beta-gamma circular polarization correlation in, 17: 28296
SCANDIUM OXIDES
spectra of, infrared absorption, 17: 27840
SCANDIUM SILICIDES
production of, conditions for, 17: 27736
structure of, 17: 27736
SCATTERING
amplitude behavior in, perturbation theory of, 17: 28176
amplitudes for inelastic, spectral representations of, 17: 28209
amplitudes in, exchange effects on, 17: 28194
amplitudes in perturbation theory of, high-energy behavior of, 17: 28164
amplitudes in perturbation theory of, high-energy behavior of, 17: 28166
amplitudes in, S-matrix theory for unstable-particle, 17: 28195
analysis of heavy-ion, equivalence of optical model and phase shift, 17: 27949 (UCRL-10769)
description of, from liquid-like binary, 17: 28137 (BNL-6364)
dispersion relations for, with arbitrary mass ratios, 17: 28213
equations for meson-nucleon, algebraic, 17: 28142 (JINR-E-1262)
potential, three-particle unitarity in, 17: 28188
potential, unitary impulse approximation for multichannel three-body, 17: 28193
Regge pole parameters in, dynamical determination of, 17: 28167
theory of planar three-particle, 17: 28177
vertex functions in, asymptotic values of relativistic, 17: 28216
SCINTILLATION
use of, for studying metastases of thyroid adenocarcinoma, 17: 26996
SCINTILLATION DETECTORS
description of vise-configuration, for beta counting, 17: 27694
efficiency measurement of liquid, channels ratio method for, 17: 27689
light collection efficiency of, methods for increasing, 17: 27703
use in determining decay rate of carbon-14-labeled compounds, 17: 27453
use of color scheme for beta-gamma discrimination, 17: 27704
use of liquid, for assay of radioactive paper chromatographs, 17: 27275
SEA URCHINS
heavy water effects on morphology of eggs, 17: 26975
SEA WATER
corrosive effects on chromium–iron–nickel alloys at 550°F, 17: 27749 (KAPL-M-CC-3)
desalinization plant for, reference design of nuclear, 17: 28499
SEALS AND GLANDS
design of closure for access holes in boiler, 17: 27528(P)
SEED
radiation effects on soybean, genetic, 17: 27071(T) (OTS-62-11755/2 (p.99-100))
SEIGNETTOELECTRIC MATERIALS
electronic dipoles and internal electric fields in, 17: 27393(T)
SELENIUM
separation from tellurium, methods for, 17: 27401
SELENIUM ISOTOPES Se-73
decay of, arsenic-73 double isomerism from, 17: 28319
SEMICONDUCTOR DETECTORS
fabrication of compensated oxide-passivated silicon-junction-type, 17: 27695
response to fission fragments, multiplication phenomenon in, 17: 27702
SEMICONDUCTORS
radiation-defect annihilation in, theory for, 17: 27928(T)
radiation effects at 4.2°K, design of cryostat for electron, 17: 28091
radioinduced electron-cavity pair formation in, 17: 27932
SEPARATION PROCESSES
analytical procedures for, 17: 27231(R) (IDO-14605)
development of foam, for waste solutions, 17: 28584(R) (RAI-113)
SERVOMECHANISMS
operation of, in DRAGON charging machine, 17: 28539
SHALES
radioactivity in sedimentary, in gas and oil fields in Japan, 17: 27579
SHELTERS
psychologic discomfort survey, 17: 27611
survival ration, nutritional evaluation, 17: 27612
testing for habitability, 17: 27598 (NRL-5882)
SHIELD TEST POOL REACTOR
neutron flux measurements in, 17: 27423(R) (TID-18195)
SHIELDED CONTAINERS
requirements for shipping radioisotopes, 17: 27586 (AHSB(RP)R-23)
SHIELDING
against protons during space flight, 17: 27596 (NP-12905)
bibliography of literature examined by Radiation Shielding Information Center at ORNL, 17: 28409 (ORNL-RSIC-1)
development at Ispra Research Center, 17: 28407 (EUR-142.d)
evaluation of, for facility used in whole-body radioactivity counting, 17: 27516
SHIPPING
economic analysis of, of spent domestic and foreign reactor fuels to reprocessing plant in USA, 17: 28446 (ORNL-TM-590)
of irradiated research reactor fuel, 17: 28562 (EUR-185.f,d,e)
of radioactive materials by truck, economical control of risks in, 17: 27599 (NYO-9773)
of radioisotopes for agricultural research, safety measures in, 17: 27627
regulations for radioisotopes, 17: 27586 (AHSB(RP)R-23)
SHIPPINGPORT PRESSURIZED WATER REACTOR
fuel element fabrication for, development of nondestructive testing methods for, 17: 27560 (WAPD-T-1530)
operation summary, April 1963, 17: 28525(R) (DLCS-5000463)
testing of automatic data logging and computing system for, 17: 28524 (DLCS-4000201(Rev.))
SHOCK TUBES
chlorine recombination rate in, direct measurement of atomic, 17: 27373
shock front visualization in electromagnetic, 17: 28041
shock fronts in, curvature of, 17: 28038
SHOCK WAVES
book: *Electrically Energized Shock Tubes*, 17: 28402
profiles in microwave interferometers, determination of longitudinal, 17: 27662
propagation in jet propulsion gases, 17: 27538(R) (NP-12767)
properties in relativistic, anisotropic, magnetohydrodynamics, 17: 28066
SILANES
heat of formation of SiH_4, Si_2H_6, and Si_3H_8, 17: 27322 (UCRL-7301-T)
SILICON
effects on corrosion of Zircaloy-2 at high temperatures, 17: 27751 (WAPD-T-1567)
partition coefficients and reciprocal ionic radii, 17: 27562 (INSJ-54)
radiation-defect annealing in, 17: 27928(T)
radiation defects in lithium-doped, electron, 17: 27927(T)
SILICON CARBIDES
properties of, dispersion velocity dependence on mechanical and thermal, 17: 27873
radioinduced stresses in, from fission fragment bombardment, 17: 27888 (BMI-1635)
SILICON CRYSTALS
radiation effects in phosphorus-doped, illumination and temperature dependence of gamma, 17: 27898
radiation effects on, proton, 17: 27891 (JINR-P-1247)
radioinduced, electron-cavity pair formation in p-n layers of, 17: 27932
SILICON HYDRIDES
SbH_3–Si_2H_6, heat of explosion, 17: 27322 (UCRL-7301-T)
SILICON ISOTOPES Si-28
energy levels of, parity and spin for, 17: 28324
energy levels of, parity and spin for 12.54-Mev resonance, 17: 28328
neutron reactions (n,α) with, intensity fluctuations in excitation functions for, 17: 28295
SILICON ISOTOPES Si-29
neutron total cross sections at 3–5 Mev, fast, 17: 28287
SILICON ISOTOPES Si-30
proton reactions (p,α) at 1177–1509 kev, phosphorus-31 excited states from angular correlations and distributions from, 17: 28321
SILICON JUNCTIONS
radiation effects on nonequilibrium-carrier lifetime in, neutron, 17: 27929(T)
SILICON OXIDES

fabrication of fused, by slip casting, 17: 27807(R) (TID-18891)
ion exchange properties of, in nitrate melts, 17: 27500
sintering of slip-cast, 17: 27807(R) (TID-18891)
Al_2O_3–SiO_2–Na_2O, ion exchange properties of, in nitrate melts, 17: 27500
Ni–SiO_2, catalytic effects on isotope exchange between anisole or xylene and deuterium oxide, 17: 27387
SiO_2–ZrO_2, ion exchange properties of, in nitrate melts, 17: 27500

SILICON SYSTEMS
Al–Nb–Si–Ti, oxidation by air at 760 to 1360°C, 17: 27780(R) (DRL-2104)
Fe–Si, stress of, dislocation mobility in, 17: 27783(R) (GA-4227)
Fe–Si–U, phase studies, 17: 27858
Nb–Si–Sn, superconducting properties of Nb_3SnSi, 17: 27861
Pu–Si, phase studies, 17: 28565(R) (LAMS-2915)
Si–Zr, atomic number effects correction in electron probe microanalysis of, 17: 27268

SILVER
analysis for microimpurities in solid, spectrographic, 17: 27308
diffusion of oxygen in, pressure and temperature dependence of, 17: 27821
oxygen-16 reactions at 167 Mev, charged-particle yields in, 17: 28252 (UCRL-10693)
photon reactions with, proton angular distributions and yields at >8 Mev, 17: 28265
spectra in reaction zone of acetylene air flame, excitation of atomic, 17: 27371(T)
wetting behavior of liquid, on solid beryllium, effects of atmosphere and temperature on, 17: 27795 (ORNL-3438)
x-ray spectra of, using promethium-147 beta source, 17: 27280
xenon-133 ranges and retention at 1–150 kev, energy and flux dependence of, 17: 28002

SILVER ALLOYS
Au–Ag, atomic number effects correction in electron probe microanalysis of, 17: 27268

SILVER CHLORIDES
vapor pressures at high temperatures, 17: 28058

SINGLE CRYSTALS
growth in arc-image furnace, 17: 27515

SIOUX FALLS POWER REACTOR
startup organization and program for preoperational testing of, 17: 28521 (ACNP-6112(Rev.1))
superheater heat transfer and pressure drop testing, 17: 28522 (ACNP-62030)

Si_3N
analysis for estrogen in, of broilers fed 3,4-dianisyl-2-t-3-hexene, use of tritium for, 17: 27050
radiation effects on tritium content in mouse, 17: 27181
radiation effects on conductivity of rabbit, 17: 27089
radiation injuries of, treatment, 17: 27104
radioinduced carcinoma on, after therapy for hemangioma, 17: 27130
radiotherapy of hemangiomas, design of soft x-ray tube for, 17: 26991
radiotherapy of tumors of, dosage determination for, 17: 27009

SKIN DISEASES
treatment of, using radium-224, radiation hazards in, 17: 27608

SLUG ELEMENTS
failure in reactors, design of detection system for, 17: 28515(P)

SODIUM
analysis for carbon, method for, 17: 27244(T) (AEC-tr-5839)
analysis for elemental carbon, isotope dilution mass spectrometry method for, 17: 27317 (NAA-SR-7918)
analysis for nitrogen, volumetric, 17: 27232 (LA-2892)
analysis for oxygen, use of mercury method for, 17: 27245(T) (AEC-tr-5840)
analysis of liquid, for oxygen, 17: 27731 (NASA-TM-X-884)
compatibility with plutonium nitride at 600°C, 17: 26944(R) (BMI-1630 (Del.))
corrosive effects on chromium–nickel and nickel steels at 1000°C, 17: 27756
exchange reactions with calcium, magnesium, and potassium on ion exchange resin, equilibrium constant for, 17: 27038
flowmeter for, suitability of E-core flux-distortion type, 17: 27655 (NAA-SR-Memo-6117)
heat transfer research on, 17: 27535 (BNL-801)
neutron cross sections for, fast, 17: 28245 (KFK-120)
partition coefficients and reciprocal ionic radii, 17: 27562 (INSJ-54)
research programs on liquid, in France and Great Britain, 17: 27731 (NASA-TM-X-884)
spectra in reaction zone of acetylene air flame, excitation of atomic, 17: 27371(T)
wear of carburized steel ball on iron in liquid, at 400 to 1200°F, 17: 26944(R) (BMI-1630(Del.))

SODIUM ALLOYS
K–Na, analysis of liquid, for oxygen, 17: 27731 (NASA-TM-X-884)
K–Na, performance of thermionic diodes with liquid collectors of, 17: 27988
K–Na, research programs on liquid, in France and Great Britain, 17: 27731 (NASA-TM-X-884)

SODIUM AZIDES
radiation effects on photoelectric properties of, 17: 27468

SODIUM BROMIDE CRYSTALS
spectra of, F-center positions in, 17: 27377

SODIUM CHLORIDE CRYSTALS
neutron scattering by, structure factors for cold, 17: 27392(T)
spectra of, F-center positions in, 17: 27377

SODIUM CHLORIDES
$MgCl_2$–KCl–NaCl, rate processes in packed column during bismuth extraction from, 17: 27492 (BNL-791)

SODIUM FLUORIDE CRYSTALS
electron-nuclear double resonance and electron paramagnetic resonance spectra of, F-center structure from, 17: 27376
spectra of, F-center positions in, 17: 27377

SODIUM FLUORIDES
BeF_2–NaF–UF_4, phase diagram, 17: 27336

SODIUM HYDROXIDES
reactions with sulfuric acid, heats of, 17: 27323 (UCRL-7325-T)

SODIUM IODIDE CRYSTALS
neutron scattering by, structure factors for cold, 17: 27392(T)
spectra of, F-center positions in, 17: 27377

SODIUM IODIDES
use of iodine-131-labeled, for tumor localization in man and rats, 17: 26992

SODIUM IONS
electron affinities of, relativistic and nonrelativistic, 17: 27996
transference numbers in pure liquid sodium nitrate, 17: 27345

SODIUM ISOTOPES Na-23
alpha reactions (n,p) at 22 Mev, angular distributions from, 17: 28288
nuclear magnetic resonance spectra of, in electrolyte solutions, 17: 27365

SODIUM ISOTOPES Na-24
production cross sections for, target mass dependence of, 17: 28247(R) (TID-18788)

SODIUM MOLYBDATES
reaction of, with thorium for quantitative precipitation of thorium molybdate, 17: 27457

SODIUM NITRATES
ion transference numbers in liquid, 17: 27345
polymerization effects on tetravalent plutonium in acid media, 17: 27319 (ORNL-TM-585)
radioinduced radical formation in, annealing of, 17: 27422 (TID-17105)

SODIUM OXIDES
Al_2O_3–SiO_2–Na_2O, ion exchange properties of, in nitrate melts, 17: 27500

SODIUM PERCHLORATES
effects on iodine-131 uptake by thyroid gland, 17: 27048

SODIUM REACTOR EXPERIMENT
fuel elements for, hydraulic testing of 9-rod assembly for 3rd core, 17: 28443 (NAA-SR-Memo-8406)
shutdown of, identification of real and spurious scrams in, 17: 28442 (NAA-SR-Memo-6688)

SOILS
analysis for strontium-90, samples collected in 1962, 17: 27592(R) (HASL-138)
calcium exchange with plants, tracer study, 17: 27046

density measurements of, using gamma scattering method, 17: 27301
erosion, moisture, and layer profiles of, radioisotopes in study of, 17: 27583
fallout levels in Italian, 1961, 17: 27591 (EUR-223.i)
properties of Belgium for retention of radioelements, 17: 27602(T) (EURAEC-416)

SOLAR BATTERIES
use of silicon, in radiation dosimetry, 17: 27696

SOLAR FLARES
bibliography, 17: 27937 (AID-62-155)
effects on geomagnetic field, data for 1962, 17: 28113
effects on solar magnetic field, 17: 28109
prediction of, review, 17: 28124
proton emission from May 12, 1959, 17: 27596 (NP-12905)
radiation exposure to astronauts from, recommended allowable, 17: 27605
radiation from, low-rigidity, 17: 28130

SOLAR RADIATION
emission of low-energy, relation to type IV radio outbursts, 17: 28121
emission of r-f, high-resolution study of 3–21 cm, 17: 28110
heating effects of ultraviolet, on ionospheric electrons, 17: 28115
intensities above sea level, spectral, 17: 27201

SOLENOIDS
critical-current degradation, model for, 17: 27944 (NP-12908)

SOLID PROPELLANTS
combustion kinetics, 17: 27538(R) (NP-12767)

SOLIDS
analysis for microimpurities in, spectrographic, 17: 27308
Mossbauer effect on impurity nuclei in, 17: 28340
radioinduced faults in, review of theoretical and experimental results on, 17: 27906
vapor pressure of porous, measurement by Knudsen effusion method, 17: 27341

SOLUTIONS
alkaline, radiation chemistry, 17: 27180

SOLVENT EXTRACTION PROCESSES
behavior of di-*n*-butyl phosphorothioic acid in, for metal ions, 17: 27408
behavior of dialkyl phosphorodithioic acids in, 17: 27407
equipment development for, 17: 27501

SONIC INSPECTION
methods for stainless steel weld overlay using twin-angle beam search unit, 17: 27761 (TID-18871)

SOVIET UNION
radioactivity of clays in oil well sections in Crimea and Eastern Caucasus Foreland, 17: 27572

SOYBEANS
radiation effects on biological characteristics and chemical composition of kernels, 17: 27071(T) (OTS-62-11755/2(p.99-100))

SPACE
environment simulation, use of gaseous and liquid helium in facility for, 17: 28075
gamma production in, experiments for determination of, 17: 28061
research in, spectroscopic, 17: 27669
simulation of, liquid helium and nitrogen supply systems for heat-sink and vacuum, 17: 28078

SPACE FLIGHT
book: *Problems in Cosmic Biology*, 17: 27196
effects of, on man, 17: 27115
effects on biological indexes in Drosophila, 17: 27200
effects on hematopoietic organs in mice, 17: 27198
manned interstellar, feasibility of relativistic, 17: 26959
mission parameters for Martian round-trip, using dual electric-nuclear engine, 17: 28575
radiation exposure to astronauts from solar flares, recommended allowable, 17: 27605
radiation hazards from protons, 17: 27596 (NP-12905)
radiation hazards, 17: 27197
rendezvous of Mariner II with Venus, 17: 28577

SPACE VEHICLES
materials for, performance under simulated space conditions, 17: 27506 (NP-12906)
nuclear-powered, development of heat rejection systems for, 17: 28574(R) (PWA-2197)
propellant systems of, foams and plastic films for insulation of cryogenic, 17: 28090
propellant tanks of, insulation of liquid-hydrogen, 17: 28086
propellant tanks of, external insulation for liquid-hydrogen, 17: 28087
propellant tanks of, compressible external insulation for liquid-hydrogen, 17: 28088
propellant tanks of, internal insulation for liquid-hydrogen, 17: 28089
shielding of, minimum structural mass for magnetic, 17: 28410

SPALLATION PRODUCTS
charge distributions from complex nuclei, 17: 28253 (UCRL-10741)

SPARK DETECTORS
characteristics of neon–alcohol chamber, 17: 27697
design and performance of discharge chamber, 17: 27705

SPECTRA
isotopic shifts in, 17: 27396
properties of, statistical, 17: 27938 (BNL-6396)

SPECTRAL SHIFT CONTROL REACTOR
design analysis, 17: 28456 (TID-7650(p.172-93))

SPECTROMETERS
design and operation of quantometer for analysis of nuclear materials, 17: 27270
design of HDIX, for neutron-diffraction studies of crystals and powders, engineering drawings for, 17: 27674

SPECTROSCOPY
developments of, at Idaho Chemical Processing Plant, 17: 27231(R) (IDO-14605)
limits of self-absorption, 17: 27294(T)
Zeeman effect in magnetic field, 17: 28034(T)

SPERM
radiosensitivity, 17: 27090

SPINELS
reactions with graphite, mechanism for, 17: 27344

SPIRO[5.5]UNDECANE, 1,5,7,11-TETRATHIA-
preparation by reaction of trimethylene trithiocarbonate and 2,2'-iminodiethanol, 17: 27412

SPLEEN
effects of cell-free extract, on recovery of bone marrow from radiation injury, 17: 27073
phosphatase activity in, after injection of hematopoietic tissue in irradiated mice, 17: 27111
radiation effects on mouse, cosmic, 17: 27198
radiation effects on rat, pre-exposed to low doses, 17: 27137
radioinduced nucleoprotein loss in cell nuclei of, in first four hours after x irradiation, 17: 27157

STABLE ISOTOPES
catalog, ORNL, 17: 26961
characteristics of available, 17: 26962

STAINING
removal from stripping-film radioautographs, procedure for, 17: 26988

STAINLESS STEEL
analysis of microspheres, activation, 17: 27253
corrosion by steam at 275°C, effects of manganese dioxide, potassium permanganate, and sodium hydroxide on, 17: 27730(R) (HW-77052)
corrosion by uranyl sulfate solution at 280°C, in-pile, 17: 27750 (ORNL-3099)
gamma emission from thermal neutron activation of types 304 and 347, 17: 27889 (EUR-103.f)
oxidation of type 310, by nitrogen–oxygen at 1750°F, 17: 28528(R) (IDO-28607)
radiation effects on AISI 316, 17: 27730(R) (HW-77052)
radiation effects on tensile properties at cryogenic temperature, neutron, 17: 28102
radiation effects on mechanical properties of AISI 348 and 304, 17: 27730(R) (HW-77052)
thermal conductance of interfaces with uranium dioxide, 17: 27546
thermal-stress-fatigue properties of type 304, 17: 27775(R) (ATL-T-135)
welding of, for gas-loop development, 17: 27730(R) (HW-77052)
welds in, sonic inspection using twin-angle beam technique, 17: 27761 (TID-18871)
wetting by hydrogen, contact angle for, 17: 28083
SS–UO_2, performance of fuel elements of, 17: 27863

STAINLESS STEEL (AUSTENITIC)
stress-corrosion cracking of types 304, 308, 309, 310, and 316, by boiler water at 500°F and sea water at 550°F, 17: 27749 (KAPL-M-CC-3)
STAINLESS STEEL POWDERS
thermal conductivity, 17: 27368
STANDARDS
for solution calorimetry, 17: 27323 (UCRL-7325-T)
for water radioactivity, 17: 27613
radiation quantities and units, 17: 27625
STARS
elements in, ionization equilibrium equation for, 17: 28112
structure of low-mass, models for, 17: 28108
STATISTICS
theory for energy levels of complex systems, 17: 28282
theory of eigenvalues of random matrices, 17: 28283
STEAM
heat transfer and pressure drop of superheated, in thin annulus, 17: 28522 (ACNP-62030)
STEAM POWER PLANTS
accidents in, arrangement for preventing pressure buildup in steam-releasing, 17: 28550(P)
STEARIC ACID, ETHYL ESTER
protective effects against lethal irradiation in mice, 17: 27156
STEEL
carbon content of mild, effects of radiation and strain aging on, 17: 27909
properties of, book on impurity effects on, 17: 27881
radiation effects on strength of, electron, 17: 27905
radiation effects on free carbon in mild, 17: 27909
stresses in, feasibility of infrared detection of, 17: 27508 (SCTM-59-63(25))
wear of carburized, against iron in argon and sodium at temperatures up to 1200°F, 17: 26944(R) (BMI-1630(Del.))
welds in, sonic inspection using twin-angle beam technique, 17: 27761 (TID-18871)
STELLARATORS
bibliography, 17: 28361 (NP-12921)
plasma stability in, interchange, 17: 28389
STELLARATORS (C)
discharges in, source of neutral atoms and molecules in, 17: 28348 (MATT-161)
plasma equilibrium in, current-carrying toroidal, 17: 28393
STIBINES
heat of explosion, 17: 27322 (UCRL-7301-T)
heat of formation, 17: 27322 (UCRL-7301-T)
SbH_3–$B_{10}H_{14}$, heat of explosion, 17: 27322 (UCRL-7301-T)
SbH_3–Ge_2H_6, heat of explosion, 17: 27322 (UCRL-7301-T)
SbH_3–Si_2H_6, heat of explosion, 17: 27322 (UCRL-7301-T)
STRAIN GAGES
installation and use in tests of EGCR pressure vessel tests, 17: 28482 (TID-18888)
STRANGE PARTICLES
production from meson (K) and (π) interactions with hyperons (Σ), isotopic relations for, 17: 28172
production in meson (π^-) reactions on xenon nuclei, 17: 28339
STRESS ANALYSIS
by infrared spectroscopy, feasibility of, 17: 27508 (SCTM-59-63(25))
STRONTIUM
determination in carbonatites, spectrographic, 17: 27228 (EUR-32.f)
intake effects on histology of rats on calcium-deficient diet, 17: 27018
metabolism in man, tracer study, 17: 27049
metabolism in rats, tracer study, 17: 27029
partition coefficients and reciprocal ionic radii, 17: 27562 (INSJ-54)
separation from waste solutions by combined iron-phosphate coagulation and foam process, 17: 28584(R) (RAI-113)
separation from waste solutions by combined sodium carbonate-hydroxide precipitation and foam process, 17: 28584(R) (RAI-113)
spectra in reaction zone of acetylene air flame, excitation of atomic, 17: 27371(T)
STRONTIUM BORIDES
electron structure and physical properties of crystals of, 17: 27875
STRONTIUM COMPLEXES
formation and properties of α-picoline–thiocyanate, 17: 27332
STRONTIUM ISOTOPES
determination in biological materials, 17: 27165
permissible body dose for man, 17: 27165
separation from milk, by ion exchange, 17: 27223(P)
STRONTIUM ISOTOPES Sr-85
uptake by bone metastases from breast cancer, 17: 27019
uptake of, by bones in young rats, effects of fluoridated water on, 17: 27044
STRONTIUM ISOTOPES Sr-89
absorption by soil, 17: 27602(T) (EURAEC-416)
accumulation by plants, genetic factors in, 17: 27055
content in vegetation in Italy, 1961, 17: 27591 (EUR-223.i)
STRONTIUM ISOTOPES Sr-90
beta emission from, determination of end-point energy of, 17: 28183
concentration in human bones of babies and placenta, 17: 27033
content in animals and vegetation in Northern Alaska from fallout, 17: 27053 (HW-SA-3050)
content in bones, food, lake waters, plants, and soil in Italy, 1961, 17: 27591 (EUR-223.i)
determination in food, radiochemical, 17: 27276
determination in milk, soil, water, air, diet, and bone, 17: 27592(R) (HASL-138)
removal of, contamination from milk, 17: 27606
separation from milk, method for, 17: 27038
separation from waste by Dowex-50W and clinoptilolite, 17: 28581(R) (HW-77299)
separation from yttrium-90, use of pyridine in precipitation with ferric hydroxide, 17: 27447
STRONTIUM ISOTOPES Sr-91
beta sorption from, as function of atomic number, 17: 28184
STRONTIUM SULFATES
sorptive properties for phosphorus-32, effects of iron(III) on, 17: 27363
STRUCTURAL PANELS
shielding effects of interior, on dose rates in windowless buildings, 17: 27601 (TO-B-63-6)
STRUCTURES
dose rates in windowless, effects of interior partitions on, 17: 27601 (TO-B-63-6)
STYRENE POLYMERS
radiation effects on photoconductivity of, 17: 27893 (TID-18843)
radiation effects on photoconductivity decay of, 17: 27895 (TID-18857)
radiolysis of copolymer with polymethylmethacrylate, formation of peroxides in, 17: 27475
polyethylene–rubber, radiation effects on structure of, 17: 27931
STYRENES
radioinduced graft polymerization on wool, 17: 27900
butadiene–styrene, radiation effects on structure of, 17: 27931
SUCCINIC ACID
reactions with hydrochloric acid, heat of, 17: 27323 (UCRL-7325-T)
SUCROSE
properties in damped oscillating manometer, time-dependent, 17: 27654 (LADC-5535)
radiation effects on, electron spin resonance investigations of gamma, 17: 27454
SULFUR
protective effects of colloidal, against radiation damage in polymers, 17: 27438
SULFUR ISOTOPES S-32
alpha reactions (α,p) at 22 Mev, angular distributions from, 17: 28288
neutron activation rates for, fast, 17: 28221 (EUR-107.f)
photon reactions (γ,n) at 22 Mev, cross sections for, 17: 28286
SULFUR ISOTOPES S-33
neutron total cross sections at 3–5 Mev, fast, 17: 28287
SULFUR ISOTOPES S-35
preparation of carrier-free, 17: 28271
uptake of, by uterine structures in guinea pigs, effects of estrogens on, 17: 27034
SULFURIC ACID
reactions with sodium hydroxide, heat of, 17: 27323 (UCRL-7325-T)
SUN
corona of, extreme ultraviolet spectrum of, 17: 28105

elements in, ionization equilibrium equation for, 17: 28112
magnetic field and winds of, termination of, 17: 28111
magnetic field of, solar flare effects on, 17: 28109
spot formation cycle of, time variation of low rigidity cosmic rays during, 17: 28130
wind flux of, interpretations for geomagnetic storms by, 17: 28116
wind interactions with geomagnetic fields, interplanetary magnetic field effects on, 17: 27574

SUPERCONDUCTIVITY
initiation of, effects in, 17: 27951(T) (AEC-tr-5850)
theory of, applications to nuclear theory, 17: 28069

SUPERCONDUCTORS
critical-current degradation in solenoids, model for, 17: 27944 (NP-12908)
critical temperature of alloyed, impurity effects on, 17: 28044
electron tunneling between, two-particle, 17: 28037
magnetic field production by, 17: 27936 (AERE-M-1207)
magnetic properties of hard, a-c, 17: 28099
magnetization curve of alloyed, near second critical field, 17: 28068
magnetization of hard, hysteresis in, 17: 27993
microwave effects and switching speed of tin, nonlinear, 17: 28045
properties of iron and vanadium films, 17: 28046
properties of niobium–tin alloys with aluminum, antimony, germanium, and silicon, 17: 27861
transients in unprotected coil of, normal-transition electric and thermal, 17: 28100
transition temperatures in indium–tin alloys, 17: 28047
use in high-field magnets, 17: 28074

SUPERFLUIDITY
theory of, applications to nuclear theory, 17: 28069

SUPERHEATERS (NUCLEAR)
design, 17: 28549
heat transfer and pressure drop testing in, 17: 28522 (ACNP-62030)

SURFACE WATERS
cesium-137 and strontium-90 levels in, in Italy, 1961, 17: 27591 (EUR-223.i)

SUSPENSIONS
flow of gas-solid, in experimental loop, 17: 27541(P) (TID-18909)
flow of gas-solid, in experimental loop, 17: 27542(R) (TID-18910)
stability of homogeneous fluidized beds, 17: 27325(T) (AERE-Trans-942)

SWEDEN
uranium (IV-VI) oxide mining and processing in, 17: 27489

SWIMMING POOL REACTORS
design for producing short-lived radioisotopes, 17: 28571(P)
enclosure design for, 17: 28569(P)
hazards summary for University of Cincinnati, 17: 28566 (NP-12915)

SYRINGES
radiosterilization of disposable hypodermic, economics of, 17: 27646

SYSTEMS FOR NUCLEAR AUXILIARY POWER
design, 17: 28576

SYSTEMS FOR NUCLEAR AUXILIARY POWER (SNAP-2)
coolant boiling research for, 17: 27535 (BNL-801)
criticality studies, 17: 28481 (TID-18880)

SYSTEMS FOR NUCLEAR AUXILIARY POWER (SNAP-8)
component development, 17: 27535 (BNL-801)

SYSTEMS FOR NUCLEAR AUXILIARY POWER (SNAP-10)
criticality studies, 17: 28481 (TID-18880)
mechanical and thermochemical testing for safety hazards analyses during abort and re-entry, 17: 28573 (NAA-SR-8304)

T

TANKS
insulation for liquid-hydrogen, 17: 28086
insulation of liquid-hydrogen, 17: 28087
insulation of liquid-hydrogen, 17: 28088
insulation of liquid-hydrogen, internal, 17: 28089

TANTALUM
analysis for oxygen, 17: 27257
brazing, exothermic, 17: 27760(R) (NP-12901)
carbon-12 scattering by, phase shift analysis of, 17: 27949 (UCRL-10769)
corrosion by cerium–cobalt–plutonium alloys, 17: 28565(R) (LAMS-2915)
deformation, thermally activated, 17: 27879
gamma reactions at 1–2 Mev, electron pair cross section Z-dependence from, 17: 28275
oxidation of, use of alpha spectroscopy in studying anodic, 17: 27753
proton scattering at 730 Mev, differential cross sections and polarizations for, 17: 28157 (UCRL-10637)
reactions with uranium-bearing reactor fuels, 17: 27961
separation from niobium and titanium, methods for, 17: 27401
tensile properties, 17: 27733(R) (NMI-2116)
thermionic emission by, 17: 27976
welding of, apparatus for, 17: 27768
work function, 17: 27970
work functions for thermionic cathodes of carburized, 17: 27975
xenon-133 ranges and retention at 1–150 kev, energy and flux dependence of, 17: 28002

TANTALUM ALLOYS
phase diagrams of binary and ternary, 17: 27778 (DMIC-183)
Co–Ta, phase studies, 17: 28565(R) (LAMS-2915)
Hf–Ta–W, tensile properties, 17: 27733(R) (NMI-2116)
Mo–Nb–Ta–W, tensile properties, 17: 27812(R) (WADD-TR-61-134(Pt.II))
Ru–Ta, cold rolling schedules and tensile properties for, 17: 27733(R) (NMI-2116)
Ta–Ti, superconducting critical currents at 4.2°K, 17: 28101
Ta–W, tensile properties, 17: 27733(R) (NMI-2116)
Ta–W, tensile properties, 17: 27878
Ta–W–Zr, tensile properties, 17: 27733(R) (NMI-2116)

TANTALUM CARBIDES
bibliography on properties, 17: 27809 (UCRL-7284)
electrochemical properties of, for use as electrodes in redox systems, 17: 27346
phase transformation above 2000°C, 17: 27835

TANTALUM CRYSTALS
deformation at 77°K, effects of prestrain at room temperature on, 17: 27783(R) (GA-4227)

TANTALUM ISOTOPES Ta-181
oxygen-16 elastic scattering at 166-Mev, inelastic contributions to, 17: 28259 (UCRL-10825)

TANTALUM NITRIDES
electron structure and physical properties of crystals of, 17: 27875
sintering of, electron density in phase lattices and optimal conditions for, 17: 27767

TANTALUM OXIDES
phase transitions and x-ray diffraction in, 17: 27788(R) (LRR-41)
radiation effects on photoconductivity of, 17: 27893 (TID-18843)
$MgO–Ta_2O_5$, phase studies, 17: 27834
$Nb_2O_5–Ta_2O_5$, equilibrium diagram of, 17: 27788(R) (LRR-41)

TANTALUM SILICIDES
electron structure and physical properties of crystals of, 17: 27875

TECHNETATES
ammonium hexachloro-, technetium production from decomposition of, 17: 27739

TECHNETIUM
determination, coulometric and polarographic techniques for, 17: 27249
production of, ammonium hexachlorotechnetate decomposition and electrodeposition for bulk, 17: 27739
solvent extraction from aqueous solutions by methyltricaprylammonium chloride, 17: 27494

TECHNETIUM FLUORIDES
amplitude vibrations and thermodynamic functions of, 17: 27334

TEETH
analysis for alpha-emitting elements, radiochemical, 17: 27172
calcium-45 uptake by, in Rhesus monkeys, 17: 27039

TELLURIUM
determination as impurity in bismuth, spectrographic, 17: 27309
diffusion from single-crystal uranium carbide, 17: 27784 (GA-4267)
separation from antimony targets, 17: 27425
separation from selenium, methods for, 17: 27401
separation of iodine-131 from irradiated, chromatographic, 17: 27495

TELLURIUM ISOTOPES Te-128
carbon-12 reactions, effects of angular momentum on excitation functions of, 17: 28346

TELLURIUM ISOTOPES Te-130
carbon-12 reactions, effects of angular momentum on excitation functions of, 17: 28346
proton reactions (p,n) with, excitation function for, 17: 28247(R) (TID-18788)
TELLURIUM SYSTEMS
Ni–Te, structure and superconductivity in, 17: 27816(T) (UCRL-Trans-921)
Pb–Te, structure and superconductivity in, 17: 27816(T) (UCRL-Trans-921)
Pt–Te, structure and superconductivity in, 17: 27816(T) (UCRL-Trans-921)
Rh–Te, structure and superconductivity in, 17: 27816(T) (UCRL-Trans-921)
TENSILE PROPERTIES
of body-centered-cubic metals, theory of, 17: 27730(R) (HW-77052)
of two-phase dispersion-strengthened crystalline materials, theory of, 17: 27882
TERBIUM
electron paramagnetic resonance of impurities of, in calcium iron crystal, 17: 27864
partition coefficients and reciprocal ionic radii, 17: 27562 (INSJ-54)
TERBIUM BORIDES
electron structure and physical properties of crystals of, 17: 27875
TERBIUM ISOTOPES Tb-159
coulomb excitation with oxygen-16 ions, energy levels in, 17: 28299
TEREPHTHALIC ACID, ETHYLENE POLYMER ESTERS
radiation effects on photoconductivity of Mylar, 17: 27893 (TID-18843)
radiation effects on electric and insulating properties of, 17: 27907
x-ray absorption in Mylar film, 17: 27057 (MMPP-196-2)
TERPHENYL
coking in Santowax OMP, effects of heating on, 17: 27423(R) (TID-18195)
fluorescence of naphthalene-containing, characteristics of, 17: 27451
properties as reactor coolant, 17: 27404 (NAA-SR-Memo-7426)
radiation effects on Santowax OMP under in-pile conditions at 600°F, 17: 28441(R) (MITNE-29)
radiation effects in STPR, effects of geometry on, 17: 27423(R) (TID-18195)
solubility in benzene and hexane, 17: 27423(R) (TID-18195)
thermodynamic properties of meta- and ortho-, 17: 28433(R) (IDO-11005)
benzene-*m*-terphenyl, radiolysis of deuterated and normal, products in, 17: 27418 (IDO-16876)
TESTOSTERONE
effects of, on radiosensitivity of rats, 17: 27209
effects of, on sulfur-35 uptake by uterine structures in guinea pigs, 17: 27034
TEXTILES
grafting to acrylonitrile, post-irradiation, 17: 27634(R) (NCSC-2477-4)
ignition by nuclear explosions, effects of burst heights and atmospheric conditions on, 17: 27945 (NP-12936)
radiation effects on physical properties of, 17: 27634(R) (NCSC-2477-4)
radiation effects on wool fibers, 17: 27899
radioinduced graft polymerization to acrylonitrile, effects of oxygen on, 17: 27634(R) (NCSC-2477-4)
spectra of radioisotopes in, gamma, 17: 27634(R) (NCSC-2477-4)
THALLIUM
determination as impurity in bismuth, spectrographic, 17: 27309
deuteron fission at 7–21 Mev, cross sections and fragment angular distributions from, 17: 28314
solvent properties for uranium, 17: 27394
spectra in reaction zone of acetylene air flame, excitation of atomic, 17: 27371(T)
THALLIUM ISOTOPES Tl-193
nuclear properties of isomeric, 17: 28255 (UCRL-10764)
THALLIUM ISOTOPES Tl-195
nuclear properties of isomeric, 17: 28255 (UCRL-10764)
THALLIUM ISOTOPES Tl-197
nuclear properties of isomeric, 17: 28255 (UCRL-10764)
THALLIUM ISOTOPES Tl-199
nuclear properties of isomeric, 17: 28255 (UCRL-10764)
THALLIUM ISOTOPES Tl-204
beta emission from, determination of end-point energy of, 17: 28183
beta sorption from, as function of atomic number, 17: 28184
THERMAL INSULATION
design for liquid-hydrogen airborne tanks, 17: 28087
design of compressible external, for airborne liquid-hydrogen tanks, 17: 28088
design of internal, for liquid-hydrogen airborne tanks, 17: 28089
development of foams and plastic films for cryogenic propellant systems, 17: 28090
properties for liquid hydrogen airborne tanks, 17: 28086
THERMAL RADIATION
energy from, storage device for, 17: 28104(P)
THERMAL REACTORS
calculation of, use of two-group and multigroup theory for, 17: 26951
energy transfer cross sections for, computer program for evaluating, 17: 28417 (AEEW-M-318)
future of breeder, 17: 28545
neutron average extrapolation length in, second order correction to, 17: 28420 (CNAEM-8)
neutron balance in, modified two-group theory model for, 17: 28231
physics of thorium-fueled, 17: 28451 (TID-7650(p.57-75))
THERMIONIC CELLS
cathode systems for nuclear, materials problems in, 17: 27960
cathodes for, properties of boride, 17: 27966
chemical regeneration of sublimating metallic surfaces in, 17: 27968
collector work function in, reduction of, 17: 27972
collectors for, analysis of liquid, 17: 27987
design, 17: 28560(P)
design and performance of, with space charge neutralization by ion injection, 17: 27982
design of nuclear, 17: 28554(P)
development, 17: 27954
efficiency and space charge compensation in noble-gas-filled, 17: 27981
electric discharges in, theory for, 17: 27980
emitter corrosion in, 17: 27964
emitter for, properties of uranium carbide as, 17: 27969
emitter materials for noble-gas-plasma, development, 17: 27962
evaporation of molybdenum in cesium-filled, 17: 27967
heat flow between electrodes in, method for calculating, 17: 27979
ionization near cesium-coated collectors in, 17: 27974
materials reactions in cesium vapor, 17: 27965
performance and theory of auxiliary-discharge, 17: 27983
performance of flame-heated, 17: 27963
performance of, using film boiling liquid metal collectors, 17: 27988
space charge neutralization in fossil fuel-fired, sources of positive ions for, 17: 27984
space charge neutralization by fission fragment ionization of noble gases in, 17: 27985
space charge neutralization in, by radioactive gas, 17: 27986
thermal conductivity of cesium vapor in, method for measuring, 17: 27958
thermal conductivity of cesium vapor in, 17: 27959
THERMOCOUPLES
design of device for breaking cables in reactor prior to fuel element removal, 17: 28512(P)
output and sensitivity of chromel-constantan, 17: 27789(R) (MLM-1156)
use for generation of magnetic field for plasma beam containment, 17: 28404(P)
THERMOELECTRIC PROPERTIES
review, 17: 27998
THERMOMETERS
development of infrared, for monitoring surface temperatures of reactor fuel elements during irradiation, 17: 27652 (HW-SA-3036)
THERMONUCLEAR EXPLOSIONS
effects on very-low-frequency propagation, 17: 26954
uranium-238 fission product yields for, 17: 28260 (USNRDL-TR-642)
THERMONUCLEAR REACTIONS
bibliography, 17: 28361 (NP-12921)
tori design for studies of, electric discharge, 17: 28403(P)
THERMONUCLEAR REACTORS
design for bombardment of pellets by high-energy ion pulses, 17: 28406(P)

ion injection device for, design of, 17: 28405(P)
THICKNESS GAGES
bremsstrahlung source design for, 17: 27681(P)
THIOCYANATES
butyl ester-thiocyanate, solvent properties for scandium, 17: 27369
THORIUM
conference on thorium fuel cycle, Gatlinburg, Tenn., Dec. 5 to 7, 1962, 17: 28447 (TID-7650)
content in primordial solar system from lead-206/207 ratio, 17: 27575
content in sedimentary rocks in gas and oil fields in Japan, 17: 27579
determination in granite, 17: 27295
determination in rock samples from Deccan Traps, spectroscopic, 17: 27571
determination in rocks, evaluation of reagents for, 17: 27246
determination of, colorimetric procedure using Chrome Azurol S, 17: 27214
determination of, gravimetric method using 3-oximinomethylsalicylic acid, 17: 27263
occurrence in granites, 17: 28450 (TID-7650(p.29-56))
processing and fabrication of, design of Kilorod Facility for, 17: 28463 (TID-7650(p.351-83))
processing of irradiated, design of facility for, 17: 28462 (TID-7650 (p.333-50))
radiation effects on, 17: 27887 (ANL-5674)
radiation effects on, testing of assemblies for determining, 17: 28474 (TID-7650(p.614-29))
radioinduced swelling, 17: 27730(R) (HW-77052)
reaction of, with sodium molybdate, amperometric study of, 17: 27457
separation from impurities by solvent extraction using liquid metals, 17: 28465 (TID-7650(p.436-53))
separation from uranium by anion exchange in acetone solution, 17: 27503
separation of uranium from, by anion exchange, 17: 27296
uses as reactor fuel, program for studying, 17: 28448 (TID-7650(p.1-18))
uses as reactor fuel, economics of, 17: 28480 (TID-7650(p.738-61))
THORIUM ALCOHOLATES
isopropoxide, infrared spectra, 17: 27727 (ASD-TDR-63-322)
isopropoxide, preparation and properties, 17: 27727 (ASD-TDR-63-322)
THORIUM ALLOYS
Be–Th–U, compatibility with niobium, tantalum, and zirconium, 17: 26944(R) (BMI-1630(Del.))
Be–Th–U, compression fracture strength, 17: 26944(R) (BMI-1630(Del.))
Pu–Th–U, phase studies and properties, 17: 28470 (TID-7650(p.543-52))
Th–U, properties of, for use as breeder reactor fuel, 17: 28467 (TID-7650(p.468-97))
Th–U, radiation effects on, 17: 27887 (ANL-5674)
THORIUM BORIDES
electron structure and physical properties of crystals of, 17: 27875
ThB–UB, physical properties, 17: 28466 (TID-7650(p.454-67))
THORIUM CARBIDES
ThC–UC, physical properties, 17: 28466 (TID-7650(p.454-67))
ThC_2–UC_2, processing of irradiated, development of aqueous methods for, 17: 28464 (TID-7650(p.384-435))
ThC–UC, properties of, for use as reactor fuel, 17: 28468 (TID-7650 (p.498-518))
THORIUM CHELATES
with Chrome Azurol S, composition and stability of, 17: 27214
THORIUM ISOTOPES Th-228
determination in bone ashes, radiometric, 17: 27285
THORIUM ISOTOPES Th-230
separation from protactinium using arsenazo III and isoamyl alcohol, radiometric, 17: 27306
THORIUM ISOTOPES Th-232
deuteron fission at 7–21 Mev, cross sections and fragment angular distributions from, 17: 28314
deuteron fission at 5.8 to 6.6 Mev, cross sections for, 17: 28337
neutron capture at 0.19–1.1 Mev, cross sections for fast, 17: 28279
THORIUM NITRATES
reduction to oxide by sol-gel process, 17: 28469 (TID-7650(p.519-42))
THORIUM ORES
geology, 17: 28449 (TID-7650(p.19-28))
processing of, 17: 28450 (TID-7650(p.29-56))
THORIUM OXIDE COATINGS
deposition on graphite by vaporization of isopropoxides, 17: 27727 (ASD-TDR-63-322)
THORIUM OXIDE SLURRIES
radiation effects on circulating, 17: 28478 (TID-7650(p.696-720))
THORIUM OXIDES
reactions with graphite, mechanism for, 17: 27344
thermodynamic properties at 2000 to 3000°K, 17: 27799 (TID-17092)
uses as reactor fuel, program for studying, 17: 28448 (TID-7650(p.1-18))
THORIUM(IV) OXIDES
atomic motion in, neutron diffraction studies of thermal, 17: 27382
bibliographies, 17: 27062(R) (TID-18722)
biological effects of infusations of, on granuloma formation, 17: 26999
crystal structure of, neutron diffraction studies of, 17: 27381
effects of Thorotrast on bactericidal properties of rabbit blood platelet serum, 17: 27125
effects on development of hemangioendothelial sarcoma in liver in man, 17: 27190
effects on development of liver metastasis after tumor cell injection, 17: 26974
effects on sarcoma development in liver in man, 17: 27081
incorporation into uranium dioxide lattice, 17: 27487
morphological changes in rat endocrine glands and reticuloendothelium, 17: 26967
oxygen vacancy motion from calcium oxide in, electrical and mechanical relaxation from, 17: 27869
pathological effects from use as radiography contrast medium, 17: 26972
pathological effects in man, delayed, 17: 27062(R) (TID-18722)
preparation from thorium nitrate by sol-gel process, 17: 28469 (TID-7650 (p.519-42))
radiation effects on, in heavy water and in inert atmosphere, 17: 28477 (TID-7650(p.675-95))
thermal conductivity, 17: 28475 (TID-7650(p.630-42))
ThO_2–UO_2, extrusion by remote methods in PCUT plant, 17: 28471 (TID-7650(p.553-84))
ThO_2–UO_2, fabrication by vibratory compaction, 17: 28472 (TID-7650 (p.585-605))
ThO_2–UO_2, fabrication of sol-gel, by swaging and vibratory compaction, 17: 28473 (TID-7650(p.606-13))
ThO_2–UO_2, preparation from thorium and uranyl nitrates by sol-gel process, 17: 28469 (TID-7650(p.519-42))
ThO_2–UO_2, processing of irradiated, development of aqueous methods for, 17: 28464 (TID-7650(p.384-435))
ThO_2–UO_2, radiation effects, 17: 28475 (TID-7650(p.630-42))
ThO_2–UO_2, radiation effects on vibratory-compacted arc-fused and sol-gel, 17: 28476 (TID-7650(p.643-74))
THORIUM RESERVES
development, 17: 28449 (TID-7650(p.19-28))
THORIUM SULFIDES
preparation and properties of sintered bodies of, 17: 27832
ThS–US, properties, 17: 27832
THORIUM SYSTEMS
C–Th–U, compatibility with niobium, tantalum, and zirconium, 17: 26944(R) (BMI-1630(Del.))
C–Th–U, compression fracture strength, 17: 26944(R) (BMI-1630(Del.))
THULIUM
partition coefficients and reciprocal ionic radii, 17: 27562 (INSJ-54)
THULIUM BORATES
crystal structure, 17: 27837
THULIUM ISOTOPES Tm-169
coulomb excitation with oxygen-16 ions, energy levels in, 17: 28299
THULIUM OXIDES
spectra of, infrared absorption, 17: 27840
THYMIDINE
self-decomposition of tritiated, in aqueous solution, 17: 27443
THYMINE
metabolism, tracer study, 17: 26982
THYMUS
radiation effects on pyridine nucleotides of thymocytes, 17: 27085
radioinduced nucleoprotein loss in cell nuclei of, in first four hours after x irradiation, 17: 27157
radiosensitivity of enzyme systems, 17: 27086

THYROID GLAND
carcinoma of, detection of pulmonary metastases in, 17: 26998
carcinoma of, use of scintillation scanning for studying metastases of, 17: 26996
function, effects on radiosensitivity in mice, 17: 27173
iodine-131 levels in, in Italy, 1961, 17: 27591 (EUR-223.i)
iodine-131 uptake by, in infants, 17: 27020
iodine-131 uptake by, effects of sodium perchlorate on, 17: 27048
iodine-131 uptake by, protective effects of potassium iodide against, 17: 27607
radiotherapy of malignant tumors of, dosimetry of, 17: 26966
sarcoma development in, following x irradiation, 17: 27184
tumors of, use of iodine-131 for diagnosis of, 17: 26993
TIME MEASUREMENT
direction of time flow, determination of, 17: 28414
TIN
absorption, 17: 28139 (ISS-63/28(p.1-11))
determination as impurity in bismuth, spectrographic, 17: 27309
distribution in Zircaloy-2, use of electron microprobe for determination of, 17: 27746(R) (DPST-63-71-1)
electron tunneling in aluminum oxide layer between superconducting lead and, two-particle, 17: 28037
gamma reactions at 1–2 Mev, electron pair cross section Z-dependence from, 17: 28275
microwave effects and switching speed of superconducting, nonlinear, 17: 28045
photon reactions (γ,d) and (γ,p) at 24 Mev, yield ratios for, 17: 28289
photon reactions with, proton angular distributions and yields at >8 Mev, 17: 28265
radioinduced reactions with 1-bromobutane, 17: 26944(R) (BMI-1630 (Del.))
separation from indium, methods for, 17: 27401
spectra in reaction zone of acetylene air flame, excitation of atomic, 17: 27371(T)
x-ray spectra of, using promethium-147 beta source, 17: 27280
TIN ALLOYS
critical temperature of superconducting, impurity effects on, 17: 28044
Al–Nb–Sn, superconducting properties of Nb_3SnAl, 17: 27861
Al–Nb–Sn–Ti, oxidation by air at 760 to 1360°C, 17: 27780(R) (DRI-2104)
Cr–Sn–Zr, analysis of corrosion films on, for zirconium-to-chromium and -to-tin ratios, 17: 27728(R) (GEAP-4076)
Cu–Sn, x-ray spectra for content ratio in, 17: 27280
Ga–In–Sn, use as gamma source, 17: 28500
Ge–Nb–Sn, superconducting properties of Nb_3SnGe, 17: 27861
In–Sn, superconducting transition temperatures in, 17: 28047
Nb–Sn, mechanical constraint effects on superconducting transitions of niobium wires coated with, 17: 28098
Sb–Nb–Sn, superconducting properties of Nb_3SnSb, 17: 27861
TIN COMPOUNDS
organic, radioinduced synthesis stannous dibromodibutyl, 17: 27481
synthesis of organic tin-aluminum polymers, 17: 27221(P)
TIN HYDRIDES
heat of formation of SnH_4, 17: 27322 (UCRL-7301-T)
TIN ISOTOPES Sn-113
neutron strength functions and widths for, 17: 28261
TIN ISOTOPES Sn-115
neutron strength functions and widths for, 17: 28261
TIN ISOTOPES Sn-117
neutron strength functions and widths for, 17: 28261
TIN ISOTOPES Sn-119
neutron strength functions and widths for, 17: 28261
TIN ISOTOPES Sn-121
neutron strength functions and widths for, 17: 28261
TIN ISOTOPES Sn-123
neutron strength functions and widths for, 17: 28261
TIN ISOTOPES Sn-124
oxygen-16 reactions, effects of angular momentum on excitation functions of, 17: 28346
TIN ISOTOPES Sn-125
neutron strength functions and widths for, 17: 28261
TIN SYSTEMS
Nb–Si–Sn, superconducting properties of Nb_3SnSi, 17: 27861
TISSUE CULTURES
radiation effects on, wavelength-dependent, 17: 27057 (MMPP-196-2)
radiosensitivity, effects of ribonucleic acid content of cells, 17: 27060 (SAM-TDR-63-17)
radiosensitivity of cells, effects of mitotic phase, 17: 27152
radiosensitivity of chromosomes in different phases of mitosis, 17: 27168
radiosensitivity of cells in, effects of 5-bromodesoxyuridine, 17: 27093
TISSUES
analysis for estrogen in adipose, in broilers fed 3,4-dianisyl-2-t-3-hexene, use of tritium for, 17: 27050
TITANIUM
alloying effects on properties of boron steel, 17: 28493
analysis for boron using curcumin, 17: 27265
corrosion by uranyl sulfate solution at 280°C, in-pile, 17: 27750 (ORNL-3099)
determination in SAP, x-ray spectrographic, 17: 27226 (EUR-21.f)
partition coefficients and reciprocal ionic radii, 17: 27562 (INSJ-54)
photon reactions with, proton angular distributions and yields at >8 Mev, 17: 28265
production from halides, 17: 27220(P)
properties of, dispersion velocity dependence on mechanical and thermal, 17: 27873
separation from niobium and tantalum, methods for, 17: 27401
wetting by hydrogen, contact angle for, 17: 28083
TITANIUM ALCOHOLATES
isopropoxide, infrared spectra, 17: 27727 (ASD-TDR-63-322)
TITANIUM ALLOYS
radiation effects on tensile properties at cryogenic temperature, neutron, 17: 28102
Al–Nb–Sn–Ti, oxidation by air at 760 to 1360°C, 17: 27780(R) (DRI-2104)
Be–Ti, wetting behavior of liquid, on solid beryllium, effects of atmosphere and temperature on, 17: 27795 (ORNL-3438)
Cr–Nb–Ti, phase studies, 17: 27826
Mo–Ti, tensile properties, 17: 27878
Mo–Ti–Zr, brazing of TZM, exothermic, 17: 27760(R) (NP-12901)
Mo–Ti–Zr, hardness and recrystallization of TZM, at high temperatures, 17: 27760(R) (NP-12901)
Nb–Ti, superconducting critical currents at 4.2°K, 17: 28101
Ta–Ti, superconducting critical currents at 4.2°K, 17: 28101
Ti–U, diffusion and material compatibility in, 17: 27857
Ti–Zr, creep properties, 17: 27830
Ti–Zr, hydrogen reaction kinetics with, 17: 27347
TITANIUM CARBIDES
bibliography on properties, 17: 27809 (UCRL-7284)
electrochemical properties of, for use as electrodes in redox systems, 17: 27346
TITANIUM CRYSTALS
structure transitions at high pressures, h-c-p to b-c-c, 17: 27871
TITANIUM ISOTOPES Ti-44
decay, 17: 28249 (UCOL-P-518)
TITANIUM ISOTOPES Ti-45
decay, gamma spectra in, 17: 28269
TITANIUM ISOTOPES Ti-46
deuteron reactions (d,p) at 21.4 Mev, energy level transition cross sections from, 17: 28323
TITANIUM ISOTOPES Ti-47
deuteron reactions (d,p) at 21.4 Mev, energy level transition cross sections from, 17: 28323
TITANIUM ISOTOPES Ti-48
deuteron reactions (d,p) at 21.4 Mev, energy level transition cross sections from, 17: 28323
TITANIUM ISOTOPES Ti-49
deuteron reactions (d,p) at 21.4 Mev, energy level transition cross sections from, 17: 28323
TITANIUM ISOTOPES Ti-50
deuteron reactions (d,p) at 21.4 Mev, energy level transition cross sections from, 17: 28323
TITANIUM ISOTOPES Ti-51
energy levels of, transition cross sections for, 17: 28323
TITANIUM NITRIDES

electrochemical properties of, for use as electrodes in redox systems, 17: 27346
electron structure and physical properties of crystals of, 17: 27875
sintering of, electron density in phase lattices and optimal conditions for, 17: 27767
TITANIUM OXIDES
electron structure and physical properties of crystals of, 17: 27875
reactions with graphite, mechanism for, 17: 27344
TITANIUM PHOSPHIDES
electron structure and physical properties of crystals of, 17: 27875
TITANIUM SILICIDES
electron structure and physical properties of crystals of, 17: 27875
TITANIUM SYSTEMS
Al–Nb–Si–Ti, oxidation by air at 760 to 1360°C, 17: 27780(R) (DRI-2104)
TOBACCO
alpha activity and free radicals in cigarette smoke, 17: 27622
TOLUENE
isotope exchange with deuterium, effects on nickel and platinum on, 17: 27389
TORI
design for heavy electric discharge, 17: 28403(P)
TRACER TECHNIQUES
for evaluating removal of pesticide residues from foods, 17: 27638 (SAN-1021)
properties of krypton-85 in, 17: 27461
theoretical aspects of studies on, 17: 26955
use in studies of detergent residues on washed food products, 17: 27637 (SAN-1020)
TRACER TECHNIQUES (AGRICULTURE)
bibliography, 17: 27635 (NP-12928)
bibliography, 17: 27636 (NP-12929)
review, 17: 27092
safety measures in, 17: 27627
TRACER TECHNIQUES (CHEMISTRY)
use in study of reaction mechanisms, review, 17: 27330
TRACER TECHNIQUES (ENGINEERING)
for determining fluid flow in pipes, 17: 27680(P)
use in chemical explosions, 17: 27640 (USNRDL-TR-638)
TRACER TECHNIQUES (GEOLOGY)
methods, 17: 27583
use for studying ground water seasonal flow variation in Salentine Peninsula of Italy by oxygen-18/oxygen-16 ratio, 17: 27565 (RT/GEO(63)-25)
TRACER TECHNIQUES (MEDICINE)
in diagnosis of intracranial tumors, 17: 26994
performance of gamma camera, 17: 27001
performance of gamma camera, 17: 27002
preparation of standardized radioautographic slides, 17: 27010
stable isotopes and activation analysis in metabolic studies, 17: 26985
TRANSFORMERS
development of d-c, with low noise and wide frequency response, 17: 27658 (UCRL-10473)
TRANSITION METALS
electron interactions in, electrical and thermal conductivity effects of, 17: 27923
TREHALOSE
radiation effects on, electron spin resonance investigations of gamma, 17: 27454
TRITIUM
determination in labeled compounds by conversion to ethane and gas counting, 17: 27273
determination in rain, benzene method for, 17: 27292
deuteron reactions (d,n) at 25 to 500 kev, anisotropy factors for determining total neutron yield from, 17: 28254 (UCRL-10752(Suppl.))
incorporation in polyvinylacetate, 17: 27413
incorporation into radioautographic smears, 17: 27010
radiation effects on content of, in organs and skin of mice, 17: 27181
use for determination of estrogen in tissues of broilers fed 3,4-dianisyl-2-e-3-hexene, 17: 27050
TRITONS
reactions (t,α) on carbon-12, distributions from, 17: 28338
yields in oxygen-16 reactions at 167 Mev, 17: 28252 (UCRL-10693)
TROPOLONES
5-sulfonic acid, analytical use for determination of uranium, 17: 27288
TRYPSIN
use for destaining stripping-film radioautographs, 17: 26988
TRYPTOPHAN
radioinduced thermoluminescence in, 17: 27427
TUBES
fabrication of impermeable graphite, 17: 27772(P) 17: 27803 (TID-18815)
growth indices in texture gradient uranium, apparatus for determining, 17: 27547
heat transfer in circular, with variable circumferential heat flux, 17: 27547
heat transfer in, formulation of, 17: 27548
heat transfer in laminar fluid flow in, 17: 27549
TUMORS
chemical and radiation effects on, mechanism of, 17: 27035
development of benign granuloma, following arteriography using thorotrast, 17: 26999
diagnosis of female genital, use of iodine-131 and phosphorus-32 for, 17: 26995
diagnosis of intracranial, performance of radioisotope techniques for, 17: 26994
diagnosis of thyroid, use of iodine-131 for, 17: 26993
eye, radiation effects on incidence of, 17: 27186
fate of Ehrlich's ascites, injected into portal system of mice, 17: 26974
homograft immune response, 17: 26987
in children, relation to prenatal radiation, 17: 27185
induced in lungs by cigarette smoke, contribution of alpha particles and free radicals to, 17: 27622
localization of human and rat, use of iodine-131-labeled compounds for, 17: 26992
metastasis prevention in liver, by use of colloidal phosphorus-32-chromic phosphate, 17: 27126
radiation effects on incidence of, in rats, 17: 27094
radiodiagnosis of bone metastases from breast cancer, 17: 27019
radiosensitivity of cells of mouse mammary, effects of membrane system and mitochondria on, 17: 27135
radiosensitivity of, effects of immune reactions on, 17: 27142
radiotherapy, 17: 26964(R) (ORINS-42)
radiotherapy of, effects of fractionation and protraction of doses on, 17: 27145
radiotherapy of malignant thyroid, dosimetry of, 17: 26966
radiotherapy of pituitary, using yttrium-90 implants, 17: 27191
radiotherapy of skin, dosage determination for, 17: 27009
radiotherapy of, using Mev-range x radiation, 17: 27000
therapy of, combined chemo- and radio-, 17: 26990
treatment of breast cancer, value of ovarian radiation, 17: 27075
TUNGSTATES
luminescence of, electric-field-induced, 17: 27342
TUNGSTEN
argon-41, krypton-85, and xenon-133 ranges and retention at 1–150 kev, energy and flux dependence of, 17: 28002
bonding to tungsten by pressure, 17: 26944(R) (BMI-1630(Del.))
brazing, exothermic, 17: 27760(R) (NP-12901)
cesium migration on, cyclic and spontaneous, 17: 27971
chemical regeneration of, in thermionic cells, 17: 27968
compatibility with uranium nitride at 1800 and 1900°C, 17: 26944(R) (BMI-1630(Del.))
compatibility with uranium dioxide at 1800 and 1900°C, 17: 26944(R) (BMI-1630(Del.))
deformation, thermally activated, 17: 27879
fabrication techniques for tubing of, development, 17: 27733(R) (NMI-2116)
hardness and microstructure of, effect of annealing on, 17: 27730(R) (NMI-2116)
hardness and recrystallization at high temperatures, 17: 27760(R) (NP-12901)
heat flow between thermionic electrodes of, 17: 27979
ionization of cesium on, graphical method for optimization of surface, 17: 27989
reactions with uranium-bearing reactor fuels, 17: 27961

separation from molybdenum, methods for, 17: 27401
tensile properties, 17: 27812(R) (WADD-TR-61-134(Pt.II))
TUNGSTEN ALLOYS
phase diagrams of binary and ternary, 17: 27778 (DMIC-183)
Hf–Nb–W, preparation and properties of, 17: 27779(R) (DRI-2102)
Hf–Ta–W, tensile properties, 17: 27733(R) (NMI-2116)
Mo–Nb–Ta–W, tensile properties, 17: 27812(R) (WADD-TR-61-134(Pt.II))
Mo–Nb–W–Zr, tensile properties, 17: 27878
Nb–W, fabrication and tensile properties of, effects of carbides on, 17: 27812(R) (WADD-TR-61-134(Pt.II))
Nb–W–Zr, preparation and properties of, 17: 27779(R) (DRI-2102)
Re–W, fabrication techniques for tubing of, 17: 27733(R) (NMI-2116)
Ta–W, tensile properties, 17: 27733(R) (NMI-2116)
Ta–W, tensile properties, 17: 27878
Ta–W–Zr, tensile properties of, 17: 27733(R) (NMI-2116)
TUNGSTEN BRONZE
electronic structure model, 17: 27843
TUNGSTEN CARBIDES
bibliography on properties, 17: 27809 (UCRL-7284)
electrochemical properties of, for use as electrodes in redox systems, 17: 27346
TUNGSTEN COMPACTS
density, 17: 27829
TUNGSTEN ISOTOPES W-185
beta emission from, determination of end-point energy of, 17: 28183
beta sorption from, as function of atomic number, 17: 28184
TUNGSTEN ISOTOPES W-186
proton reactions (p,2p) with, excitation function for, 17: 28247(R) (TID-18788)
proton reactions (p,n) with, excitation function and recoil behavior for, 17: 28247(R) (TID-18788)
TUNGSTEN OXIDES
catalytic effects on hydrocracking of polyphenyls, 17: 28434 (IDO-16858)
phase transitions and x-ray diffraction in, 17: 27788(R) (LRR-41)
Nb_2O_5–WO_3, space groups and tetragonal unit cell for, 17: 27788(R) (LRR-41)
TUNGSTEN SILICIDES
electron structure and physical properties of crystals of, 17: 27875
TUNGSTEN SYSTEMS
Cs–CsF–W, properties as thermionic emitter, 17: 27973
W–UC, properties as thermionic cell emitter, 17: 27962
W–UO_2, electric conductivity, 17: 26944(R) (BMI-1630(Del.))
W–UO_2, thermal conductivity, 17: 26944(R) (BMI-1630(Del.))
TURBINES
bearing design and performance in high-speed, gas-lubricated, 17: 27510(R) (TID-18924)
development of two-stage potassium, 17: 27535 (BNL-801)
displacements of rotor axis in, use of strontium-90 for detection of, 17: 27641

U

ULTRAVIOLET RADIATION
background for aerial observation of earth, conference, 17: 27563 (NP-12932)
effects on chromosomes in tissue cultures, effects of mitotic phase, 17: 27168
effects on inactivation of desoxyribonucleic acid primer activity, 17: 27080
effects on luminescence in *Armillaria mellea*, 17: 27179
effects on nucleotide dimer formation, 17: 27079
heating effect of solar, on ionospheric electrons, 17: 28115
refractive indices in argon and nitrogen gases, Cherenkov radiation method for vacuum, 17: 28028
refractive indices of gases, Rayleigh scattering method for vacuum, 17: 28029
spectrum of solar, 17: 28105
ULTRAVIOLET SOURCES
intensity of deuterium and hydrogen, 17: 28033(T)
performance of Kerr cell in, 17: 27671
ULTRAVIOLET SPECTROSCOPY
utilization in space research, 17: 27669
UNDERGROUND EXPLOSIONS
radioactivity from lanthanum-140-tagged chemical, 17: 27640 (USNRDL-TR-638)
uses for generating heat and power, 17: 27505 (EUR-16.f)
UNITED STATES
uranium market in, in 1962, 17: 26952
uranium market in, future prospects for, 17: 26953
URANIN
photochemical behavior of liquid and solid solutions of, spectra of, 17: 27399
URANIUM
alloying effects on forging, mechanical, and thermal properties of carbon steel, 17: 27823
content in primordial solar system from lead-206/207 ratio, 17: 27575
content in sedimentary rocks in gas and oil fields in Japan, 17: 27579
cost of enriched and depleted, AEC schedule of, 17: 27713 (TID-8539)
determination in flat fuel elements, method for, 17: 27291
determination in presence of plutonium in alloys and compounds, x-ray spectrographic, 17: 27256
determination in reactor fuel alloys, photometric, 17: 27269
determination of, autoradiographic quantitative, 17: 27266
determination of traces of, fluorimetric, 17: 27262
determination using tropolone-5-sulfonic acid, 17: 27288
electric conductivity of alpha, effects of interstitial atoms and vacancies on, 17: 27852
electron paramagnetic resonance of impurities of, in barium iron crystal, 17: 27864
electroplating of, process for, 17: 27769(P)
fission by thermal neutrons, krypton and xenon yields from, 17: 27416 (HW-73394)
fission of, antimony-127 and 129 yields in, 17: 28278
fission of natural, palladium-111 and 111m cumulative yields in, 17: 28280
fission of, ternary argon-induced, 17: 28257 (UCRL-10772)
gamma emission from thermal neutron activation of, 17: 27889 (EUR-103.f)
growth indices in texture gradient tubes of, apparatus for determining, 17: 27803 (TID-18815)
market for, potential, 17: 26957
market for, survey of 1962, 17: 26952
market in U.S., future prospects for, 17: 26953
mechanical properties of, effects of temperature on, 17: 27877
melting by use of electron beams, purifying effects of, 17: 27732 (NLCO-881)
milling and mining of, radiation hazards in, 17: 27617
phase transformation in, kinetics of alpha to beta, 17: 27851
polarography of, effects of complexing agents on, 17: 27331
production by chlorination of uranium oxides, 17: 27490
radiation effects on electric and thermal conductivity of alpha-, 17: 27911
radioinduced swelling, 17: 27730(R) (HW-77052)
separation from aluminum, iron, and thorium by anion exchange, 17: 27296
separation from fused nitrates by ion exchange, 17: 27500
separation from ores, 17: 27491(P)
separation from plutonium by ion exchange on zirconium phosphate silicate, 17: 27499
separation from protactinium using arsenazo III and isoamyl alcohol, radiometric, 17: 27306
separation from thorium using liquid-metal extraction, 17: 28465 (TID-7650(p.436-53))
separation from thorium by anion exchange in acetone solution, 17: 27503
solubilities in liquid gallium, indium, lead, and thallium, 17: 27394
structure of alpha, γ coordinate at 22 and 600°C, 17: 27819
URANIUM ALLOYS
analysis for uranium, photometric, 17: 27269
Al–U, atomic number effects correction in electron probe microanalysis of, 17: 27268
Be–Th–U, compatibility with niobium, tantalum, and zirconium, 17: 26944(R) (BMI-1630(Del.))
Be–Th–U, compression fracture strength, 17: 26944(R) (BMI-1630(Del.))

Cu–U, effects of aging and warm working on hardness of, 17: 27733(R) (NMI-2116)
fissium–U, analysis for molybdenum, palladium, rhodium, ruthenium, and zirconium, 17: 27255
Mn–U, phase transformation and grain refinement, 17: 27862
Mo–U, evidence of late grain boundaries in, 17: 27855
Mo–U, metallography, 17: 27790 (NAA-SR-Memo-8408)
Mo–U, reactions with hydrogen halides, 17: 27403(P)
Nb–U, transformation of retained β phase in, by tempering from $\beta + \gamma$, range, kinetics of, 17: 27824
Pu–Th–U, phase studies and properties, 17: 28470 (TID-7650(p.543-52))
Rh–U, analysis for rhodium, 17: 27259
Th–U, properties of, for use as breeder reactor fuel, 17: 28467 (TID-7650(p.468-97))
Th–U, radiation effects on, 17: 27887 (ANL-5674)
Ti–U, diffusion and material compatibility in, 17: 27857
U–Zr, radioinduced swelling, 17: 27730(R) (HW-77052)

URANIUM BORIDES

ThB–UB, physical properties, 17: 28466 (TID-7650(p.454-67))

URANIUM CARBIDES

analysis for carbon by combustion and absorption of carbon dioxide, 17: 27235 (PG-Report-444)
compatibility with helium at 2100°F, 17: 26944(R) (BMI-1630(Del.))
determination in fuel elements by nondestructive method, 17: 27229 (EUR-248.f)
diffusion of fission products from single-crystal, 17: 27784 (GA-4267)
electron emission by, thermal, 17: 27978
hydrolysis of, in acid or neutral medium, nature of condensed hydrocarbons formed by, 17: 27409
lattice constants, 17: 27815(T) (NP-tr-1027)
properties as thermionic emitter, 17: 27969
properties as thermionic cell emitters, 17: 27962
reactions with refractory metals, 17: 27961
structural properties of pyrolytic-carbon coated and uncoated, 17: 27796 (ORNL-TM-521)
thermionic emission by, 17: 27976
thermophysical properties of mono-, at high temperatures, 17: 27838
work function of tantalum cathodes coated with, 17: 27975
Mo–UC, properties as thermionic emitter, 17: 27962
Mo–U–UC, fabrication as fuel material for Fermi Fast Breeder Reactor, process developments for, 17: 28531 (ORNL-3437)
Nb–UC, properties as thermionic emitter, 17: 27962
Re–UC, properties as thermionic emitter, 17: 27962
ThC–UC, physical properties, 17: 28466 (TID-7650(p.454-67))
ThC_2–UC_2, processing of irradiated, development of aqueous methods for, 17: 28464 (TID-7650(p.384-435))
ThC–UC, properties of, for use as reactor fuel, 17: 28468 (TID-7650 (p.498-518))
UC–ZrC, properties as nuclear thermionic cell emitters, 17: 27960
UC–ZrC, properties as thermionic cell emitters, 17: 27962
UC–ZrC, thermionic emission by, 17: 27976
W–UC, properties as thermionic emitter, 17: 27962

URANIUM CHELATES

with trópolone-5-sulfonic acid, formation of, 17: 27286

URANIUM CHLORIDES

properties of fused, as fuel for fast breeder reactors, 17: 27797 (PAN-414/V)

URANIUM COMPLEXES

with methylaminophenol sulfate, polarographic studies on, 17: 27340
with tri-(n-octyl) phosphine oxide–di-(2-ethylhexyl) phosphoric acid, spectrophotometric analysis of synergic solvent extraction system of, 17: 27497

URANIUM(IV) FLUORIDES

analysis for boron by solvent extraction using dichloromethane, photometric, 17: 27307
preparation from molybdenum–uranium alloys, process for, 17: 27403(P)
BeF_2–NaF–UF_4, phase diagram, 17: 27336

URANIUM(VI) FLUORIDES

preparation from molybdenum–uranium alloys, process for, 17: 27403(P)

URANIUM ISOTOPES U-233

deuteron fission at 7–21 Mev, cross sections and fragment angular distributions from, 17: 28314
deuteron fission at 5.8 to 6.6 Mev, cross sections for, 17: 28337
neutron capture-to-fission ratio, epithermal, 17: 28309
preparation by irradiation of thorium, testing of assemblies for, 17: 28474 (TID-7650(p.614-29))
pricing of, as byproduct fuel, 17: 28546

URANIUM ISOTOPES U-235

determination in fuel elements by nondestructive method, 17: 27229 (EUR-248.f)
deuteron fission at 5.8 to 6.6 Mev, cross sections for, 17: 28337
fission rates for, 17: 28244 (KAPL-M-SW-2)
neutron cross sections for, fast, 17: 28245 (KFK-120)
neutron fission, cadmium ratios for slightly enriched-uranium water-moderated lattices, 17: 28135
production of, methods for calculating output and charges in, 17: 27713 (TID-8539)
separation from spent fuels, development of electrochemical equipment for, 17: 27653 (IDO-16852)

URANIUM ISOTOPES U-238

deuteron fission at 7–21 Mev, cross sections and fragment angular distributions from, 17: 28314
deuteron fission at 5.8 to 6.6 Mev, cross sections for, 17: 28337
fission product yields from, in thermonuclear explosions, 17: 28260 (USNRDL-TR-642)
neutron absorption by, in dioxide lattices, 17: 28419 (BAW-1268)
neutron cross sections for, fast, 17: 28245 (KFK-120)
neutron resonance integrals for, effective, 17: 28238 (AEEW-M-304)
neutron resonance integrals in mixtures with hydrogen, effects of temperature on, 17: 28308
reactions with neon-20, neon-22 and oxygen-16, half life of spontaneously fissionable isomer from, 17: 28241 (JINR-P-1258)
reactions with neon-20, collision effects in, 17: 28258 (UCRL-10775)

URANIUM LEACH SOLUTIONS (ACID)

evaporation, titanium vessel for, 17: 27496

URANIUM NITRIDES

compatibility with tungsten at 1800 and 1900°C, 17: 26944(R) (BMI-1630 (Del.))
decomposition pressure of UN, 17: 27356
fission gas release from irradiated, 17: 26944(R) (BMI-1630(Del.))
melting point of UN, 17: 27356

URANIUM ORES

separation of uranium from, 17: 27491(P)

URANIUM(IV) OXIDE COMPACTS

electric conductivity of sintered, effects of gas absorption on, 17: 27854
fabrication into rods by extrusion, 17: 27762(T-R) (EURAEC-368)
fabrication of pellets with high density, 17: 27773(P)
preparation by sintering, 17: 27811 (UNC-1004)
radiation effects, 17: 27737
radiation effects on deflected, Zircaloy-2-clad, swaged, 17: 27890 (HW-62762)
sintering of, solarization during steam, 17: 27740

URANIUM(IV) OXIDE POWDERS

characterization and sinterability, 17: 27811 (UNC-1004)
fabrication into pellets with high density, 17: 27773(P)
sintering, effects of atmosphere and additives on, 17: 27766
sintering to 1200°C in controlled hydrogen atmosphere, 17: 27488
solubility of sintered, in nitric acid, 17: 27338
thermal conductivity, 17: 27368

URANIUM OXIDES

chlorination of, production of uranium by, 17: 27490
determination in fuel elements by nondestructive method, 17: 27229 (EUR-248.f)
heat of formation of, measurement by dynamic difference calorimetry, 17: 27364
neutron resonance integrals for, effective, 17: 28238 (AEEW-M-304)
properties of pentavalent, comparison to americium, neptunium, and plutonium, 17: 27350

URANIUM OXIDES (Zr ALLOY CLAD)

radiation effects on defected, swaged rod of, 17: 27890 (HW-62762)

URANIUM(IV) OXIDES

atomic motion in, neutron diffraction studies of thermal, 17: 27382
buckling and void effects in light-water- and organic-cooled lattices of, 17: 28483 (TID-18895)

compatibility with molybdenum and tungsten at 1800 and 1900°C, 17: 26944(R) (BMI-1630(Del.))
compatibility with alumina and beryllia coatings, 17: 26944(R) (BMI-1630(Del.))
conference minutes on reactor fuel applications of, 17: 27734 (TID-7666)
crystal structure of, neutron diffraction studies of, 17: 27381
determination by electron probe method, correction of atomic number effects in, 17: 27268
diffusion of inert gases from irradiated, kinetics of, 17: 27886 (AERE-M-969)
fabrication, 17: 27737
neutron absorption by uranium-238 in lattices of, thermal activation method for measuring, 17: 28419 (BAW-1268)
oxidation of, heats of formation of intermediate phases in, 17: 27364
polishing of, development of baths for chemical, 17: 27763
preparation from molybdenum–uranium alloys, process for, 17: 27403(P)
preparation of, by reduction of uranyl carbonate using formaldehyde sulfoxylates, 17: 27339
processing of irradiated, 17: 27499
radiation effects on microstructure, 17: 27897 (WAPD-T-1501)
reactions with refractory metals, 17: 27961
reprocessing and fabrication of irradiated, simulation studies of, 17: 27764
solid solution formation in, during transformation in, during transformation from uranium(IV-VI) oxide, 17: 27487
thermal conductance of interfaces with stainless steel, 17: 27546
thermal conductivity of, additive effects of rare earth oxides on, 17: 27814(T) (EURAEC-103)
Mo–UO_2, electric conductivity, 17: 26944(R) (BMI-1630(Del.))
Mo–UO_2, thermal conductivity, 17: 26944(R) (BMI-1630(Del.))
Mo–U–UO_2, fabrication as fuel material for Fermi Fast Breeder Reactor, process developments for, 17: 28531 (ORNL-3437)
PuO_2–UO_2, irradiation testing in VBWR, 17: 28431(R) (GEAP-4216)
SS–UO_2, performance of fuel elements of, 17: 27863
ThO_2–UO_2, extrusion by remote methods in PCUT plant, 17: 28471 (TID-7650(p.553-84))
ThO_2–UO_2, fabrication by vibratory compaction, 17: 28472 (TID-7650 (p.585-605))
ThO_2–UO_2, fabrication of sol-gel, by swaging and vibratory compaction, 17: 28473 (TID-7650(p.606-13))
ThO_2–UO_2, preparation from thorium and uranyl nitrates by sol-gel process, 17: 28469 (TID-7650(p.519-42))
ThO_2–UO_2, processing of irradiated, development of aqueous methods for, 17: 28464 (TID-7650(p.384-435))
ThO_2–UO_2, radiation effects, 17: 28475 (TID-7650(p.630-42))
ThO_2–UO_2, radiation effects on vibratory-compacted arc-fused and sol-gel, 17: 28476 (TID-7650(p.643-74))
W–UO_2, electric conductivity, 17: 26944(R) (BMI-1630(Del.))
W–UO_2, thermal conductivity, 17: 26944(R) (BMI-1630(Del.))

URANIUM(IV-VI) OXIDES
mining and processing of, in Sweden, 17: 27489
transformation to uranium dioxide, solid solution formation during, 17: 27487
Al–U_3O_8, fabrication of, exothermic chemical reactions in, 17: 27807(R) (TID-18891)

URANIUM PEROXIDES
structure of hydrated crystals of, x-ray diffraction patterns for, 17: 27352

URANIUM SULFIDES
magnetic properties of mono-, 17: 27383
preparation and properties of sintered bodies of, 17: 27832
ThS–US, properties, 17: 27832

URANIUM SYSTEMS
C–O–U, phase studies on, 17: 27802 (TID-18809)
C–Th–U, compatibility with niobium, tantalum, and zirconium, 17: 26944(R) (BMI-1630(Del.))
C–Th–U, compression fracture strength, 17: 26944(R) (BMI-1630(Del.))
Fe–Si–U, phase studies, 17: 27858
Mo–U–UC, fabrication as fuel material for Fermi Fast Breeder Reactor, process developments for, 17: 28531 (ORNL-3437)
Mo–U–UO_2, fabrication as fuel material for Fermi Fast Breeder Reactor, process developments for, 17: 28531 (ORNL-3437)

URANYL CARBONATES
reduction to uranium dioxide by formaldehyde sulfoxylates, 17: 27339

URANYL FLUORIDES
preparation from molybdenum–uranium alloys, process for, 17: 27403(P)

URANYL NITRATES
polymerization effects on tetravalent plutonium in acid media, 17: 27319 (ORNL-TM-585)
uptake and retention by kidney in rats, effects of chelating agents on, 17: 27025

URANYL SULFATES
corrosive effects on reactor materials at 280°C, in-pile, 17: 27750 (ORNL-3099)

UREASE
radioinduced inactivation, 17: 27430

URIDINE
5-bromodesoxy-, effect on radiosensitivity of cells in tissue culture, 17: 27093

URINE
analysis for fluorine, 17: 27589 (CNI-111)
radioisotope excretion in, use of chelating agents for acceleration of, 17: 27024

UTERUS
carcinoma of cervix of, use of phosphorus-32 for diagnosing, 17: 26968
radiotherapy of cervical cancer of, percutaneous, 17: 26976
radiotherapy of, delayed radiation proctitis from, 17: 27183
sulfur-35 uptake by guinea pig structures of, effects of estrogens on, 17: 27034

V

VACUUM GAGES
calibration of ionization-type for gases other than nitrogen, 17: 27668
design of ionization-type, with photocurrent suppression, 17: 27667

VACUUM SYSTEMS
bibliography, 17: 28361 (NP-12921)
design for fast-wave plasma cyclotron amplifiers, 17: 27650(R) (AD-297382)

VAGINA
radiation effects on epithelium of, cytology of, 17: 27097

VAN ALLEN RADIATION BELTS
intensity variations at 180–250 km, conjugate points of, 17: 28127(T)
properties of, review, 17: 28131
proton spectrum, 17: 27596 (NP-12905)
review, 17: 28055
silicon photoelement lifetime in, 17: 27891 (JINR-P-1247)

VANADIUM
analysis for oxygen, 17: 27257
deformation, thermally activated, 17: 27879
determination in SAP, x-ray spectrographic, 17: 27226 (EUR-21.f)
photon reactions with, proton angular distributions and yields at >8 Mev, 17: 28265
separation from coke for production of high-purity artificial graphite, 17: 27741
superconducting transition temperatures of films of, 17: 28046

VANADIUM ALLOYS
Fe–V, ferromagnetism and atomic magnetic moments of, effects of solute concentration on, 17: 27801 (TID-17141)
Fe–V, thermodynamic properties at 1400 to 1800°K, 17: 27774 (ANL-6657)
Ga–V, mechanical constraint effects on superconducting transitions of niobium wires coated with, 17: 28098
V–Zr, hydrogen overvoltage measurements in, 17: 27728(R) (GEAP-4076)

VANADIUM CARBIDES
bibliography on properties, 17: 27809 (UCRL-7284)

VANADIUM ISOTOPES V-51
deuteron elastic scattering at 8 to 10.5 Mev, differential cross sections for, 17: 28306

VANADIUM NITRIDES
electron structure and physical properties of crystals of, 17: 27875
sintering of, electron density in phase lattices and optimal conditions for, 17: 27767

VANADIUM OXIDES

catalytic effects on hydrocracking of polyphenyls, 17: 28434 (IDO-16858)
CoO–V_2O_5, catalytic effects on hydrocracking of polyphenyls, 17: 28434 (IDO-16858)
VANADIUM SILICIDES
electron structure and physical properties of crystals of, 17: 27875
VANADIUM STEEL
Cr–Mo–U, effects of cerium on impurities, mechanical properties, and oxidation of, 17: 27859
VAPOR PRESSURE
measurement in porous solids by Knudsen effusion method, 17: 27341
VERMONT
radioactivity from natural sources, 17: 27629
VESSELS
criticality control using boron, 17: 27502
design of reactor, with radiation shield, 17: 28514(P)
VINYL ALCOHOL POLYMERS
radioinduced crosslinking of aqueous solutions of, effects of additives on, 17: 27904
radioinduced graft polymerization on vinyl acetate in aqueous and acetylated solutions, 17: 27444
VIRUSES
bonding of tobacco mosaic, to methylmercury and potassium uranyl fluoride, 17: 27043
VITAMIN B
protective effects against radiation injuries in guinea pigs, 17: 27082
VITAMIN D
formation in radiolysis of ergosterol, 17: 27473

W

WARFARE
hospital organization for nuclear, 17: 27623
survival rations for use during nuclear, 17: 27621
WASTE DISPOSAL
calcination, mercury behavior in, 17: 28581(R) (HW-77299)
calcination, pot and spray, 17: 28581(R) (HW-77299)
developments, 17: 28581(R) (HW-77299)
fixation method for liquid, with useful resultant product, 17: 28587(P)
ground, analysis of Mol site for, 17: 28579 (EURAEC-295)
methods evaluation for ultimate, of liquids and solids, 17: 28583 (ORNL-3357)
methods for, of solutions, 17: 28586(P)
principles governing radioactive contaminants, 17: 27613
solvent extraction for recovery and removal of fission products from Purex 1WW, 17: 28581(R) (HW-77299)
sorption on ion exchangers, 17: 28581(R) (HW-77299)
storage tank development, 17: 28581(R) (HW-77299)
treatment of Purex stored waste sludge, 17: 28581(R) (HW-77299)
WASTE PROCESSING
by calcination, radiant-heat spray process for, 17: 28585
cesium separation by solvent extraction using dipicrylamine, 17: 28580 (HW-76222)
foam separation methods for low-activity wastes, 17: 28584(R) (RAI-113)
incorporation of ashes and semi-dry sludges in asphalt, 17: 28579 (EURAEC-295)
WASTE SOLUTIONS
consolidation of, methods development for, 17: 28586(P)
separation of cesium from, by solvent extraction using dipicrylamine, 17: 28580 (HW-76222)
treatment of low-level, development of scavenging-precipitation ion-exchange process for, 17: 28582 (ORNL-3322)
WATER
analysis for fluorine, 17: 27589 (CNI-111)
corrosive effects on aluminum alloys, groove pitting in, 17: 27747 (HW-74359(Rev.))
corrosive effects on Zircaloy-2 at high temperatures, effects of radiation and cold work on, 17: 27729 (HW-76636)
depth-dose distribution of 160-Mev proton beam in spherical phantom filled with, 17: 27059 (ORNL-3457)
determination in iron during sintering by neutron scattering, 17: 27282
determination in methanol using krypton-85, 17: 27639(R) (TID-18881)
determination in TBP, infrared absorption spectrographic, 17: 27239 (PG-Report-467)
deuterium exchange with hydrogen ions, equilibrium constant, 17: 27380
fluoridated, effects on calcium-45 and strontium-85 uptake by bones in rats, 17: 27044
heat of formation, 17: 27322 (UCRL-7301-T)
heat transfer from cylinder rotating in, convective, 17: 27533 (AE-107)
isotopic analysis, 17: 27313(R) (ASD-TDR-62-843)
neutron attenuation by, fast, 17: 28221 (EUR-107.f)
neutron diffusion lengths in, thermal, 17: 28437 (KAPL-2000-20)
oxygen exchange with magnesia at 50 and 100°C, 17: 27313(R) (ASD-TDR-62-843)
properties in damped oscillating manometer, time-dependent, 17: 27654 (LADC-5535)
radioinduced nucleation of bubbles in, theory, 17: 28032
radiolysis in water-cooled power reactors, 17: 28538
reactions with potassium chloride, heat of, 17: 27323 (UCRL-7325-T)
H_2O–D_2O, ionic product, 17: 27379
WATER-d_2
flow of boiling, void fractions for, 17: 27532 (AE-106)
hydrogen isotope exchange with benzene and its derivatives, effects of nickel on, 17: 27384
isotope exchange with anisole and xylene, effects of catalysts on, 17: 27387
isotope exchange with propene, effects of nickel on, 17: 27390
morphological effects in sea urchin eggs, 17: 26975
preparation of, evaluation of catalysts for isotope-exchange, 17: 27388
H_2O–D_2O, ionic product, 17: 27379
WATER COOLED REACTORS
buckling and void effects in heavy-water-moderated, with uranium dioxide rod clusters, 17: 28483 (TID-18895)
design analysis of thorium-fueled, 17: 28456 (TID-7650(p.172-93))
design for water desalinization, 17: 28499
development of heavy-water-moderated, for desalination plants and power production, 17: 28526(R) (DP-845)
development of, review of present and future, 17: 28536
fuel element burnout testing in, effects of rod spacing on, 17: 28423(R) (DPST-63-69-6)
transient heat transfer analysis in, with exponential power increase, 17: 28496
water chemistry problems in, 17: 28538
WATER MODERATED REACTORS
development for power production, 17: 28526(R) (DP-845)
development of plutonium recycle for, 17: 28431(R) (GEAP-4216)
WATER SUPPLIES
analysis for strontium-90, samples collected in 1962, 17: 27592(R) (HASL-138)
restoration of metropolitan water works following nuclear attack, 17: 27595 (NP-12902)
standards of radioactive pollution, 17: 27613
WATER VAPOR
deuterium exchange with hydrogen at high temperatures and pressures, catalyst for, 17: 27719(P)
isotopic exchange of hydrogen between molecular hydrogen and, 17: 27326
WELDING
equipment for refractory metals, 17: 27768
WELDS
sonic inspection using twin-angle beam technique, 17: 27761 (TID-18871)
stress-corrosion cracking by boiler water at 500°F and sea water at 550°F, 17: 27749 (KAPL-M-CC-3)
WHEAT
strontium-89 accumulation in grain, stems, and leaves, genetic factors in, 17: 27055
WOOD
radioinduced graft polymerization with polymers, 17: 27896 (TID-18907)
WOOL
ignition by nuclear explosions, effects of burst heights and atmospheric conditions, 17: 27945 (NP-12936)
labeling of fibers with iodine-131, 17: 27216
radiation effects on fibers, 17: 27899
radioinduced graft polymerization of acrylonitrile, methyl methacrylate, and styrene on, 17: 27900

X

X RADIATION
biological effects on blood, 17: 27160
biological effects on mammalian tissue cells, wavelength-dependent effects on, 17: 27057 (MMPP-196-2)
biological effects of, effects of intensity on, 17: 27105
biological effects on antibody formation, mechanism of stimulation in, 17: 27121
biological effects on graft-host immune reactions in mice, 17: 27122
biological effects on bactericidal properties of rabbit blood platelet serum, 17: 27125
carcinogenetic effects of, on animals and man, 17: 27187
carcinogenetic effects on rats, partial and whole-body, 17: 27094
carcinogenic effects of, combined with N-nitrosodiethylamine in Wistar rats, 17: 27155
detection and measurement to 10,000 r, photographic film development techniques for, 17: 27594 (NBS-TN-161)
detection and measurement of soft, time resolution of proportional counters for, 17: 27709
diagnostic exposure, effects on induction of neoplasms in offspring, 17: 27185
dose tables and isodose charts for medium energy, depth, 17: 27633
effect on urinary excretion of phosphorus and desoxyribose in rats, 17: 27037
effects of seed exposure, on characteristics and kernel composition of soybeans, 17: 27071(T) (OTS-62-11755/2(p.99-100))
effects on abdomen and head of rabbits, irritating, 17: 27070(T) (JPRS-19806)
effects on antibody response to antigen, 17: 27178
effects on bacterial infection in dogs, 17: 27204
effects on binding of chromium-51 by liver nucleic acids and proteins, 17: 27084
effects on blood of medical personnel, data on, 17: 27620
effects on blood serum proteins, effects of age, 17: 27171
effects on brain content of 5-hydroxytryptamine in rats and mice, 17: 27110
effects on breeding characteristics of mice, 10-generation exposure of sires, 17: 27101
effects on cell division and growth, 17: 27136
effects on chromosomes in root tips of *Avena sterilis*, 17: 27087
effects on development of liver metastasis after tumor cell injection, 17: 26974
effects on development of transplanted mouse eggs, 17: 27117
effects on DNA in *Escherichia freundii* in culture, effects of chemical content of medium, 17: 27113
effects on elastic fibers in rabbit ear, 17: 27133
effects on enzyme activity in kidneys, whole-body exposure, 17: 27066 (USNRDL-TR-640)
effects on enzyme systems in thymus mitochondria, 17: 27086
effects on erythrocytes in man, rabbits, and roosters, 17: 27166
effects on fertilized eggs and developing embryos in hamsters, 17: 27119
effects on freshly sutured bronchial stumps and esophageal anastomoses in dogs, 17: 27127
effects on genetic structure of plants, 17: 27100
effects on growth of gastrointestinal tract epithelium, local-exposure, 17: 27103
effects on induction of allergic encephalomyelitis in rats, whole-body exposure, 17: 27124
effects on intestine, protective effects of β-mercaptoethylamine and blood vessel clamping on, 17: 27112
effects on kidney function in man, early, 17: 27077
effects on nervous system, local and whole-body exposure, 17: 27069(T) (JPRS-19284)
effects on nucleoli in Chang liver cells, 17: 27063 (TID-18846)
effects on nucleoprotein loss in cell nuclei in liver, thymus, and spleen in first four hours after irradiation, 17: 27157
effects on phosphatase activity in liver and spleen, effects of hematopoietic tissue injection on, 17: 27111
effects on protein synthesis in *Bacterium cadaveris*, 17: 27109
effects on pyridine nucleotides of thymocytes, 17: 27085
effects on root growth of Chenopodiaceae, Cruciferae, and Umbelliferae, 17: 27068(T) (CEA-tr-R-1678)
effects on spleen and testes in rats pre-exposed to low doses, 17: 27137
effects on tritium content in organs and skin of mice, 17: 27181
effects on tumor cells, mechanism of, 17: 27035
emission from aluminum (liquid), spectra of soft L, 17: 27865
genetic effects in Drosophila, 17: 27099
genetic effects in mice, long-term exposure, 17: 27101
genetic effects in Drosophila, effect of maternal nutrition, 17: 27102
genetic effects on *Drosophila melanogaster*, 17: 27064(R) (TID-18855)
genetic effects on corn, 17: 27091
hair dysplasia induced by exposure, protective effects of cysteamine in mice, 17: 27174
lethal effects of, protective effects of serotonin on, 17: 27154
lethal effects of whole-body exposure to, protective effects of ethyl stearate in mice, 17: 27156
luminescence of rare gases induced by, in an electric field, 17: 28011
pathological effects in developing mouse fetuses, 17: 27169
scattering by liquid-like binary, description of, 17: 28137 (BNL-6364)
scattering by nitrogen, theory, 17: 27953
therapeutic effects of Mev-range, on cancers, 17: 27000
use for diagnosis of gastrointestinal diseases, 17: 26986

X-RAY CAMERAS
development of low-temperature, for use in x-ray spectrography, 17: 27670

X-RAY-DIFFRACTION ANALYSIS
uses, 17: 27242 (TID-18925)

X-RAY EQUIPMENT
design of digital integrating dose meter for use in therapy, 17: 27164
design of soft tube for radiotherapy of hemangiomas, 17: 26991
modification of films for chest examination, diagnostic value and economics of, 17: 27610

X-RAY SPECTRA
analytical uses of, promethium-147 beta source for, 17: 27280
production, 17: 27242 (TID-18925)

X-RAY SPECTROMETERS
properties of, analytical, 17: 27242 (TID-18925)

X-RAY SPECTROSCOPY
crystal structure studies by, development of low-temperature camera for use in, 17: 27670
utilization in space research, 17: 27669

XENON
diffusion from irradiated uranium dioxide, kinetics of, 17: 27886 (AERE-M-969)
diffusion from single-crystal uranium carbide, 17: 27784 (GA-4267)
electron diffusion in plasmas of, in magnetic fields, 17: 27650(R) (AD-297382)
ionization by fission fragments in nuclear thermionic cells, 17: 27985
reactor criticality effects of, calculation for equilibrium conditions, 17: 28425 (EUR-102.f)
stability in reactors, two-group analysis of, 17: 28416 (AE-108)
ultraviolet refractive indices of gaseous, Rayleigh scattering method for vacuum, 17: 28029
yields from thermal-neutron fission of uranium, 17: 27416 (HW-73394)

XENON FLUORIDES
chemical structure, 17: 27744
heat of formation of tetra-, 17: 27321 (UCRL-7298-T)
preparation and properties of di-, hexa-, and tetra-, 17: 27327

XENON ISOTOPES
meson (π^-) reactions on, strange particles from, 17: 28329

XENON ISOTOPES Xe-133
range and retention in metals at 1–150 kev, energy and flux dependence of, 17: 28002
ranges in aluminum at 0.5–2.40 Mev, 17: 28001

XENON ISOTOPES Xe-135
neutron resonance cross sections, correction to Doppler broadening in, 17: 28307

XYLENE
hydrogen isotope exchange with deuterium oxide, effects of nickel on, 17: 27384
isotope exchange with deuterium oxide, effects of catalysts on, 17: 27387

Y

YEASTS
radiation effects on diploid and haploid, effects of oleic acid on cosmic, 17: 27199
YTTERBIUM
partition coefficients and reciprocal ionic radii, 17: 27562 (INSJ-54)
YTTERBIUM BORATES
crystal structure, 17: 27837
YTTERBIUM BORIDES
electron structure and physical properties of crystals of, 17: 27875
YTTERBIUM OXIDES
spectra of, infrared absorption, 17: 27840
YTTRIUM
partition coefficients and reciprocal ionic radii, 17: 27562 (INSJ-54)
production of pure microspheres of, 17: 27789(R) (MLM-1156)
separation from scandium by solvent extraction, 17: 27369
spectra in reaction zone of acetylene air flame, excitation of atomic, 17: 27371(T)
YTTRIUM ALLOYS
Mg–Y, atomic number effects correction in electron probe microanalysis of, 17: 27268
Sc–Y, phase studies, 17: 27785 (IS-569)
YTTRIUM BORATES
crystal structure, 17: 27837
YTTRIUM BORIDES
properties as thermionic cathodes, 17: 27966
YTTRIUM ISOTOPES Y-82
half life, 17: 28247(R) (TID-18788)
YTTRIUM ISOTOPES Y-83
half life, 17: 28247(R) (TID-18788)
YTTRIUM ISOTOPES Y-85
half life, 17: 28247(R) (TID-18788)
YTTRIUM ISOTOPES Y-90
beta emission from, determination of end-point energy of, 17: 28183
beta sorption from, as function of atomic number, 17: 28184
isomeric states of, characteristics of, 17: 28327
radiation effects of implanted, on pituitary in cancer patient, 17: 27191
separation from strontium-90, use of pyridine in precipitation with ferric hydroxide, 17: 27447
YTTRIUM ISOTOPES Y-91
beta emission from, determination of end-point energy of, 17: 28183
beta sorption from, as function of atomic number, 17: 28184
YTTRIUM OXIDES
additive effects on thermal conductivity of uranium dioxide, 17: 27814(T) (EURAEC-103)
spectra of, infrared absorption, 17: 27840
YUGOSLAVIA
monitoring atmospheric radioactivity at Sljeme and Zagreb, Feb. to May 1962, 17: 27569

Z

ZINC
determination as impurity in bismuth, spectrographic, 17: 27309
determination in carbonatites, spectrographic, 17: 27228 (EUR-32.f)
determination in SAP, x-ray spectrographic, 17: 27226 (EUR-21.f)
determination of traces in germanium dioxide, activation, 17: 27297
photon reactions with, proton angular distributions and yields at >8 Mev, 17: 28265
spectra in reaction zone of acetylene air flame, excitation of atomic, 17: 27371(T)
x-ray spectra of, using promethium-147 beta source, 17: 27280
ZINC ALLOYS
Ca–Zn, phase studies, 17: 27800 (TID-17136)
Cu–Zn, x-ray spectra for content ratio in, 17: 27280
Hg–Zn, electro- and radiochemical studies of electrode reactions of, 17: 27398
ZINC CHLORIDES
KCl–$ZnCl_2$, properties of fused, as simulated reactor fuels, 17: 27797 (PAN-414/V)
ZINC ISOTOPES Zn-65
content in vegetation in Northern Alaska from fallout, 17: 27053 (HW-SA-3050)
determination as impurity in phosphorus-32 by sorption in humus column, 17: 27284
ZINC ISOTOPES Zn-72
decay of, beta and gamma spectra from, 17: 28281
ZINC OXIDE CRYSTALS
hardness of, micro-, 17: 27343
ZINC OXIDES
incorporation into uranium dioxide lattice, 17: 27487
luminescence of, electric-field-induced, 17: 27342
ZINC SULFIDE CRYSTALS
hardness of, micro-, 17: 27343
ZIRCALOY-2
analysis for distribution of alloying elements in, using electron microprobe, 17: 27746(R) (DPST-63-71-1)
corrosion and hydrogen pickup in water at high temperatures, effects of radiation and cold work on, 17: 27729 (HW-76636)
corrosion by carbon dioxide at 450°C, 17: 27730(R) (HW-77052)
corrosion by heavy-water steam at 400°C, 17: 27730(R) (HW-77052)
corrosion by steam at 400°C and water at 360°C, effects of nitrogen, oxygen, and silicon on, 17: 27751 (WAPD-T-1567)
corrosion by uranyl sulfate solution at 280°C, in-pile, 17: 27750 (ORNL-3099)
corrosion of, studies by electron microprobes, 17: 28533(R) (SRO-83)
creep properties of pressure tubes of, 17: 27822
creep properties of, in-reactor measurements of, 17: 27730(R) (HW-77052)
creep tests of sheet, 17: 26944(R) (BMI-1630(Del.))
radiation effects on, 17: 27730(R) (HW-77052)
radiation effects on mechanical properties of, 17: 27730(R) (HW-77052)
radiation effects on corrosion of, by water at 280°C, 17: 27730(R) (HW-77052)
sorptive properties for hydrogen, 17: 27751 (WAPD-T-1567)
stress-corrosion cracking by boiler water at 500°F and sea water at 550°F, 17: 27749 (KAPL-M-CC-3)
welding of, electron-beam, 17: 28526(R) (DP-845)
ZIRCALOY-4
stress-corrosion cracking by boiler water at 500°F and sea water at 550°F, 17: 27749 (KAPL-M-CC-3)
ZIRCONIUM
analysis for boron using curcumin, 17: 27265
analysis for hafnium, activation, 17: 27289
content in zirconyl phosphates, ratio to phosphorus, 17: 27351
corrosion by carbon dioxide at 450°C, 17: 27730(R) (HW-77052)
corrosion by heavy-water steam at 400°C, 17: 27730(R) (HW-77052)
corrosion by uranyl sulfate solution at 280°C, in-pile, 17: 27750 (ORNL-3099)
determination in fissium–uranium alloys, fluorescent x-ray spectrometric, 17: 27255
determination of milligram levels of, gravimetric, 17: 27298
diffusion of hydrogen in beta-, at 760 to 1010°C, coefficients for, 17: 27844
gamma reactions at 1–2 Mev, electron pair cross section Z-dependence from, 17: 28275
hydridation of, effects of carbon dioxide on, 17: 27730(R) (HW-77052)
hydrogen overvoltage measurement in, 17: 27728(R) (GEAP-4076)
neutron scattering cross section and resonance parameters for, fast, 17: 28437 (KAPL-2000-20)
partition coefficients and reciprocal ionic radii, 17: 27562 (INSJ-54)
photon reactions with, proton angular distributions and yields at >8 Mev, 17: 28265
plastic deformation of, role of twinning in, 17: 28533(R) (SRO-83)
separation from hafnium, methods for, 17: 27401
separation from hydrochloric, nitric, and sulfuric acid solutions by solvent extraction using *N*-benzoylphenylhydroxylamine, 17: 27305
separation from protactinium using arsenazo III and isoamyl alcohol, radiometric, 17: 27306
solvent properties of alpha-, for chromium at 360 to 400°C, 17: 27728 (GEAP-4076)
xenon-133 ranges and retention at 1–150 kev, energy and flux dependence of, 17: 28002

ZIRCONIUM ALCOHOLATES
isopropoxide and t-butoxide, preparation and properties, 17: 27727 (ASD-TDR-63-322)
isopropoxide, infrared spectra, 17: 27727 (ASD-TDR-63-322)
isopropoxide, thermal decomposition in air, argon, helium, and nitrogen, 17: 27727 (ASD-TDR-63-322)
ZIRCONIUM ALLOYS
development as fuel element cladding material for steam-cooled reactors, 17: 27728(R) (GEAP-4076)
Al–Nb–Zr, hardness, 17: 27779(R) (DRI-2102)
Al–Zr, atomic number effects correction in electron probe microanalysis of, 17: 27268
Be–Zr, oxidation of aluminum-containing $ZrBe_{13}$ and Zr_2Be_{17} at 650 to 1000°C, 17: 27781(R) (DRI-2105)
Be–Zr, wetting behavior of liquid, on solid beryllium, effects of atmosphere and temperature on, 17: 27795 (ORNL-3438)
Cr–Sn–Zr, analysis of corrosion films on, for zirconium-to-chromium and -to-tin ratios, 17: 27728(R) (GEAP-4076)
Cu–Nb–Zr, hydrogenation of, delayed failure from, 17: 28533(R) (SRO-83)
Cu–Zr, hydrogen overvoltage measurements in, 17: 27728(R) (GEAP-4076)
Hf–Zr, corrosion by steam at 316 and 400°C, 17: 27728(R) (GEAP-4076)
Mg–Zr, fatigue properties at 200 to 500°C, 17: 27847
Mo–Nb–W–Zr, tensile properties, 17: 27878
Mo–Ti–Zr, brazing of TZM, exothermic, 17: 27760(R) (NP-12901)
Mo–Ti–Zr, hardness and recrystallization of TZM, at high temperatures, 17: 27760(R) (NP-12901)
Nb–W–Zr, preparation and properties of, 17: 27779(R) (DRI-2102)
Nb–Zr, a-c losses in superconducting wires of, 17: 28099
Nb–Zr, corrosion by uranyl sulfate solution at 280°C, in-pile, 17: 27750 (ORNL-3099)
Nb–Zr, critical current in magnets of, 17: 27944 (NP-12908)
Nb–Zr, hydrogen overvoltage measurements in, 17: 27728(R) (GEAP-4076)
Nb–Zr, properties during superconducting transition, 17: 27942 (NIRL/R/32)
Nb–Zr, superconducting properties for use in high-field magnets, 17: 28074
Nb–Zr, superconducting critical currents at 4.2°K, 17: 28101
Nb–Zr, thermodynamic properties of capsules of, 17: 27792 (NP-12933)
Ni–Zr, hydrogen overvoltage measurements in, 17: 27728(R) (GEAP-4076)
Pd–Zr, corrosion by uranyl sulfate solution at 280°C, in-pile, 17: 27750 (ORNL-3099)
Pt–Zr, corrosion by uranyl sulfate solution at 280°C, in-pile, 17: 27750 (ORNL-3099)
Sc–Zy, phase studies, 17: 27785 (IS-S69)
Ta–W–Zr, tensile properties of, 17: 27733(R) (NMI-2116)
Ti–Zr, creep properties, 17: 27830
Ti–Zr, hydrogen reaction kinetics with, 17: 27347
U–Zr, radioinduced swelling, 17: 27730(R) (HW-77052)
V–Zr, hydrogen overvoltage measurements in, 17: 27728(R) (GEAP-4076)
ZIRCONIUM CARBIDES
bibliography on properties, 17: 27809 (UCRL-7284)
heat flow between thermionic electrodes of, 17: 27979
phase transformation above 2000°C, 17: 27835
properties of, dispersion velocity dependence on mechanical and thermal, 17: 27873
thermionic emission in cesium vapor, 17: 27977
work function of tantalum cathodes coated with, 17: 27975
UC–ZrC, properties as nuclear thermionic cell emitters, 17: 27960
UC–ZrC, properties as thermionic cell emitters, 17: 27962
UC–ZrC, thermionic emission by, 17: 27976
ZIRCONIUM CRYSTALS
corrosion by water at 680°F, 17: 27748 (KAPL-2257)
structure transitions at high pressures, h-c-p to b-c-c, 17: 27871
ZIRCONIUM ELECTRODES
frequency dependence of oxidized, in oxidation-reduction media, 17: 27397
ZIRCONIUM FILMS
oxidation of thin, kinetics of, 17: 27754
ZIRCONIUM HYDROXIDES
free energy of formation, 17: 26944(R) (BMI-1630(Del.))
ZIRCONIUM ISOTOPES Zr-95
content in children and stillborn infants, 17: 27013 (TID-18878)
content in vegetation in Italy, 1961, 17: 27591 (EUR-223.i)
content in vegetation in Northern Alaska from fallout, 17: 27053 (HW-SA-3050)
ZIRCONIUM MINERALS
industrial hygiene in mines, 17: 27603(T) (JPRS-19866)
ZIRCONIUM NITRIDES
electron structure and physical properties of crystals of, 17: 27875
sintering of, electron density in phase lattices and optimal conditions for, 17: 27767
ZIRCONIUM OXIDE COATINGS
deposition on graphite by vaporization of isopropoxides, 17: 27727 (ASD-TDR-63-322)
ZIRCONIUM OXIDE POWDERS
thermal conductivity, 17: 27368
ZIRCONIUM OXIDES
analysis for distribution of alloying elements in, using electron microprobe, 17: 27746(R) (DPST-63-71-1)
compatibility with graphite, 17: 26944(R) (BMI-1630(Del.))
determination by electron probe method, correction of atomic number effects in, 17: 27268
pathological effects from use as radiography contrast medium, 17: 26972
phase transformation at high temperatures, 17: 27876
properties of, dispersion velocity dependence on mechanical and thermal, 17: 27873
radioinduced stresses in, from fission fragment bombardment, 17: 27888 (BMI-1635)
$BeO–MgO–ZrO_2$, phase studies, 17: 27833
$BeO–ZrO_2$, phase studies, 17: 27833
$Cr_2O_3–ZrO_2$, characterization of hot-pressed, 17: 27728(R) (GEAP-4076)
$CuO–ZrO_2$, characterization of hot-pressed, 17: 27728(R) (GEAP-4076)
$Fe_3O_4–ZrO_2$, characterization of hot-pressed, 17: 27728(R) (GEAP-4076)
$MgO–ZrO_2$, phase studies, 17: 27833
$NiO–ZrO_2$, characterization of hot-pressed, 17: 27728(R) (GEAP-4076)
$PuO_2–ZrO_2$, phase diagram, 17: 27836
$SiO_2–ZrO_2$, ion exchange properties of, in nitrate melts, 17: 27500
ZIRCONIUM PHOSPHATES
ion exchange properties of, in nitrate melts, 17: 27500
ZIRCONIUM SILICIDES
electron structure and physical properties of crystals of, 17: 27875
ZIRCONIUM SYSTEMS
O–Zr, crystal structure of, ligand field theory of, 17: 27817
Si–Zr, atomic number effects correction in electron probe microanalysis of, 17: 27268
ZIRCONYL PHOSPHATES
radiation effects on properties of, infrared absorption at 40–1000°C, 17: 27351

REPORT NUMBER INDEX

All reports, translations, and patents abstracted in this issue are included in this index. Each item is listed by report number; this is followed by the abstract number and a brief notation regarding public availability. The index entries show, when known, which reports are on file in the depository libraries, which reports have been published in open-literature journals (journal citation given), and which reports can be purchased (source and price). Whenever a report is identified by more than one number, cross references from secondary to primary report numbers are cited.

The report number codes apply to AEC reports unless designated otherwise. Non-AEC reports are identified by parenthetical notes after the report codes; e.g., (non-AEC), (British), (Canadian), (French). The note (Misc.) identifies those codes used for both USAEC and non-AEC reports. The report numbers for the non-AEC reports in these series are marked with an asterisk (*). Patents are listed under the heading "PATENTS"; the country of origin is included in parentheses.

A comprehensive listing of both AEC and non-AEC report codes is contained in TID-85(2nd Rev.), *Report Number Series Used by the Technical Information Service in Cataloging Reports*. March 1960, $2.75 (OTS), and supplement, August 1960, $0.50 (OTS).

Public Availability of USAEC Reports

All USAEC reports abstracted in *NSA* are available to the public through one or more of the following sources:

(1) Depository libraries in the United States, in other countries, and in international agencies. A list of these depositories, many of which have facilities for preparing photocopy for sale, appears on the inside covers of each issue of *NSA*.

(2) Scientific and technical journals or other publications.

(3) Microcard Editions, Inc., in Microcard form. Orders and inquiries should be sent to: Accounting and Shipping Department, West Salem, Wisconsin.

(4) Office of Technical Services, U. S. Department of Commerce, Washington 25, D. C., for sale as full-size printed copy, photostat or facsimile (Xerox), and microfilm.

(5) Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C., for sale as full-size printed copy.

Public Availability of Non-AEC Reports

U. S. Reports. Many reports of U. S. Government agencies other than the AEC can be obtained by the public in the same manner as AEC reports. The availability of these reports is given when known. If availability is not shown, inquiries should be directed to the Office of Technical Services. Inquiries concerning "NP" reports should be by title and author rather than by NP number.

Non-U. S. Reports. Many reports of atomic energy establishments of other countries are placed in the depository libraries in the United States, where they are available for public use. Other reports appear in the journal literature. Some British reports are sold by the British Information Service, 45 Rockefeller Plaza, New York 20, N. Y. Some Canadian reports are sold by Atomic Energy of Canada Ltd., Chalk River, Ontario, Canada. This index identifies any type of public availability known to the USAEC.

Abbreviations Used in Availability Column

AECL	For sale by Atomic Energy of Canada Ltd., Chalk River, Ontario, Canada.
BIS	For sale by the British Information Service, 45 Rockefeller Plaza, New York 20, N. Y.
Dep.	AEC reports: Full-size copy is on deposit in the depository libraries both in and outside the United States. These reports are also for sale by Microcard Editions, Inc., Accounting and Shipping Department, West Salem, Wisconsin. Non-AEC reports: Full-size copy on deposit in the depository libraries in the United States only.
Dep.(mc)	Same as for Dep., except copy is in Microcard form.
DSIR	For sale by the Department of Scientific and Industrial Research, Lending Library Unit, 20 Chester Terrace, London, N. W. 1, England.
DTI Extension	Available from the U. S. Atomic Energy Commission, Division of Technical Information Extension, P. O. Box 62, Oak Ridge, Tennessee.
EM	Blueprints of AEC engineering drawings are available from the Oak Ridge Reproduction Service, Post Office Box 363, Oak Ridge, Tennessee. They are also available in photographically reduced form from Cooper-Trent, Inc., Wilson Boulevard at Danville Street, Arlington 1, Virginia, and from the Rapid Blueprint Company, 818 Santee, Los Angeles, California.
GPO	For sale by the Superintendent of Documents, Government Printing Office, Washington 25, D. C.
HMSO	Her Majesty's Stationery Office, London.

IAEA	Available from the International Atomic Energy Agency.
JCL	For sale by the Special Libraries Association Translation Center, John Crerar Library, 86 E. Randolph Street, Chicago 1, Illinois.
NAS	National Academy of Sciences, National Research Council, Washington 25, D. C.
NRC	For sale by the National Research Council of Canada, Ottawa, Ontario, Canada.
OTS	For sale by the Office of Technical Services, Department of Commerce, Washington 25, D. C.
UKAEA, London	Available from United Kingdom Atomic Energy Authority, 11 Charles II Street, London, S. W. 1.
USGS	Available free-of-charge from the U. S. Geological Survey, Washington 25, D. C.

(The symbols "ph," "mf," and "fs" are used to designate that copy is available only in photostat, microfilm, or facsimile (Xerox) form.)

Report No.	Abstract No.	Availability
AAEC-TM-	**(Australian)**	
152	17-27850	J. Nucl. Mater., 8: 227-31(1963)
173	17-28308	Nucl. Sci. Eng., 16: 243-5(1963)
ACNP-		
6112(Rev.1)	17-28521	Dep.(mc); $6.60(fs), $2.30(mf) OTS
62030	17-28522	Dep.(mc); $3.60(fs), $1.31(mf) OTS
AD-	**(Misc.)**	
282467*	17-27885	$7.60(OTS)
285328*	17-27937	See AID-62-155
287500*	17-27798	See RADC-TDR-62-307
290086*	17-28357	$3.60(OTS)
297382*	17-27650	$3.60(OTS)
402685*	17-27601	See TO-B-63-6
405712*	17-27414	See ASD-TR-7-840A(IX)
405963*	17-27066	See USNRDL-TR-640
AE-	**(Non-AEC)**	
102	17-28237	Dep.(mc)
106	17-27532	Dep.(mc)
107	17-27533	Dep.(mc)
108	17-28416	Dep.(mc)
AEC-tr-		
5822	17-27243	Dep.(mc); $1.60(fs), $0.80(mf) JCL or OTS
5838	17-27735	Dep.(mc); $1.10(fs), $0.80(mf) JCL
5839	17-27244	Dep.(mc); $1.10(fs), $0.80(mf) JCL
5840	17-27245	Dep.(mc); $1.60(fs), $0.80(mf) JCL
5850	17-27951	Dep.(mc); $1.10(fs), $0.80(mf) JCL
5855	17-27715	Dep.(mc); $1.10(fs), $0.80(mf) JCL or OTS
5858	17-27566	Dep.(mc); $1.10(fs), $0.80(mf) JCL or OTS
AECL-	**(Canadian)**	
1715	17-27777	See CW-R&DL-31
1725	17-28001	Can. J. Phys., 41: 329-43(1963)
1726	17-28002	Can. J. Phys., 41: 844-57(1963)
1765	17-27585	Dep.; $1.00(AECL)
AEEW-M-	**(British)**	
304	17-28238	Dep.; $1.12(BIS); 8s. (HMSO)
318	17-28417	Dep.; $0.35(BIS); 2s. 6d. (HMSO)
AEEW-R-	**(British)**	
172	17-28418	Dep.; $0.77(BIS); 5s. 6d. (HMSO)
AERE-AM-	**(British)**	
68	17-27224	Dep.; $0.35(BIS); 2s. 6d. (HMSO)
AERE-M-	**(British)**	
969	17-27886	Dep.
1203	17-27534	Dep.; $0.49(BIS); 3s. 6d. (HMSO)
1207	17-27936	Dep.; $0.56(BIS); 4s. (HMSO)
AERE-R-	**(British)**	
2148	17-27851	J. Nucl. Mater., 8: 232-40(1963)
3851	17-28062	Spectrochim. Acta, 19: 971-87(1963)
4007	17-27910	J. Nucl. Mater., 8: 221-6(1963)
4135	17-27860	Nature, 198: 952-7(1963)
4173	17-28277	J. Inorg. Nucl. Chem., 25: 607-14(1963)
4295	17-27225	Dep.; $0.56(BIS); 4s. (HMSO)
AERE-Trans-	**(British)**	
942	17-27325	Dep.
AHSB(RP)-R-	**(British)**	
23	17-27586	Dep.; $1.40(BIS); 10s. (HMSO)
AID-	**(Non-AEC)**	
62-155	17-27937	$3.60(OTS)
ANL-		
5674	17-27887	Dep.; $0.75(OTS)
6657	17-27774	Dep.; $1.50(OTS)
6709	17-28219	Dep.; $0.50(OTS)
6718	17-28239	Dep.; $1.00(OTS)
ANL-FGF-		
373	17-27834	J. Am. Ceram. Soc., 46: 174-7(1963)
374	17-27801	See TID-17141
APED-	**(Non-AEC)**	
5000	17-28561	Dep.(mc); $19.75(fs), $9.33(mf) OTS
ARL-	**(Non-AEC)**	
63-62	17-28358	
AROD-	**(Misc.)**	
2099.12*	17-27311	
2099.13*	17-27312	
ASD-TDR-	**(Non-AEC)**	
62-843	17-27313	OTS
63-322	17-27727	
ASD-TR-	**(Non-AEC)**	
7-840A(IX)	17-27414	$10.50(OTS)
ATL-A-		
135	17-27775	Dep.(mc); $3.60(fs), $1.28(mf) OTS
AWRE-E-	**(British)**	
12/63	17-28117	Dep.(mc)
BATT-	**(Non-AEC)**	
4673-T2	17-27792	See NP-12933
BAW-	**(Misc.)**	
1268	17-28419	Dep.; $1.25(OTS)
BM-RI-	**(Misc.)**	
6248*	17-27314	Free (Bureau of Mines)
BMI-	**(Misc.)**	
1630(Del.)	17-26944	Dep.; $2.00(OTS)
1635	17-27888	Dep.; $0.50(OTS)
BNL-		
400(Vols.I&II)	17-28240	Dep.; $8.50(OTS)
791	17-27492	Dep.; $0.50(OTS)
801	17-27535	Dep.; $1.25(OTS)
6354	17-27415	Dep.(mc); $1.10(fs), $0.80(mf) OTS
6358	17-27776	Dep.(mc); $2.60(fs), $0.83(mf) OTS
6363	17-28136	Dep.(mc); $1.10(fs), $0.80(mf) OTS
6364	17-28137	Dep.(mc); $1.60(fs), $0.80(mf) OTS
6396	17-27938	Dep.(mc); $4.60(fs), $1.46(mf) OTS
6471	17-27176	Radiation Res., 19: 337-44(1963)
6839	17-27380	Proc. Chem. Soc., 141-3(1963)
7120	17-28347	Dep.(mc); $1.10(fs), $0.80(mf) OTS
BNL-PR-		
2	17-27535	See BNL-801
BNL-T-		
301	17-27492	See BNL-791
CAPE-		
863	17-27674	EM
866	17-27673	EM
872	17-27519	EM
942	17-27518	EM
944	17-27672	EM

Report No.	Abstract No.	Availability
954	17-27517	EM
956	17-27402	EM
985	17-28502	EM
988	17-27520	EM
990	17-28354	EM
997	17-27521	EM
1004	17-27516	EM
CEA-tr-	**(French)**	
R-1678	17-27068	$2.60(fs), $1.01(mf) JCL or OTS
CERN-	**(European Organization for Nuclear Research)**	
63-17	17-27056	Dep.(nc)
CEX-		
62.6.2	17-26945	Dep.; $0.50(OTS)
CLM-R-	**(British)**	
3	17-28359	Dep.; $0.56(BIS); 4s. (HMSO)
CLOR-	**(Polish)**	
15	17-27587	Dep.
CNAEM-	**(Turkish)**	
8	17-28420	Dep.(nc)
CNAM-	**(Turkish)**	
5	17-28421	Dep.(nc)
CNI-	**(Italian)**	
109	17-27588	Dep.(nc)
111	17-27589	Dep.(nc)
CU-	**(Misc.)**	
217	17-28151	See NEVIS-111
CVNA-	**(Misc.)**	
181	17-28523	Dep.(nc); $4.60(fs), $1.49(mf) OTS
CW-R&DL-	**(Canadian)**	
31	17-27777	Dep.; $1.50(AECL)
DLCS-		
4000201(Rev.)	17-28524	Dep.(nc); $2.60(fs), $0.86(mf) OTS
5000463	17-28525	Dep.(nc); $3.60(fs), $1.34(mf) OTS
DM-	**(Misc.)**	
1203	17-27244	For translation see AEC-tr-5839
DMIC-	**(Non-AEC)**	
152	17-27778	Supplemented by DMIC-183
183	17-27778	
DP-		
845	17-28526	Dep.; $0.75(OTS)
DPST-		
63-69-3	17-28422	Dep.(nc); $1.60(fs), $0.80(mf) OTS
63-69-6	17-28423	Dep.(nc); $2.60(fs), $0.83(mf) OTS
63-71-1	17-27746	Dep.(nc); $1.60(fs), $0.80(mf) OTS
DRCL-	**(Canadian)**	
397	17-27084	Can. J. Biochem. Physiol., 41: 1349-51 (1963)
399	17-27086	Can. J. Biochem. Physiol., 41: 1486-90 (1963)
402	17-27085	Can. J. Biochem. Physiol., 41: 1469-81 (1963)
DRI-	**(Misc.)**	
2102	17-27779	Dep.(nc); $1.10(fs), $0.80(mf) OTS
2104	17-27780	Dep.(nc); $2.60(fs), $1.04(mf) OTS
2105	17-27781	Dep.(nc); $1.60(fs), $0.80(mf) OTS
DUBNA REPORTS	**(Russian)**	
See JINR (Russian)		
EANDC-E-	**(European-American Nuclear Data Committee)**	
35U	17-28245	See KFK-120
EFINS-	**(Misc.)**	
62-59	17-28263	Ann. Phys. (N. Y.), 22: 438-80(1963)
EUR-	**(European Atomic Energy Community)**	
7.f	17-27504	Dep.(nc)
14.i	17-27682	Dep.(nc)
16.f	17-27505	Dep.(nc)
21.f	17-27226	Dep.(nc)
28.f	17-27227	Dep.(nc)
32.f	17-27228	Dep.(nc)
81.e	17-28579	See EURAEC-295
83.f	17-28424	Dep.(nc)
88.f	17-27590	Dep.(nc)
89.f	17-27762	See EURAEC-368
102.f	17-28425	Dep.(nc)
103.f	17-27889	Dep.(nc)
106.f	17-28220	Dep.(nc)
107.f	17-28221	Dep.(nc)
128.i	17-26963	Dep.(nc)
129.f	17-28426	Dep.(nc)
130.f	17-28427	Dep.(nc)
140.f	17-27602	See EURAEC-416
142.d	17-28407	Dep.(nc)
149.f	17-28428	Dep.(nc)
185.f,d,e	17-28562	Dep.(nc)
223.i	17-27591	Dep.(nc)
248.f	17-27229	Dep.(nc)
271.i	17-28563	Dep.(nc)
273.f	17-27757	Dep.(nc)
EUR-C-		
4936/62e	17-27734	See TID-7666
EURAEC-		
103	17-27814	Dep.(nc); $3.60(fs), $1.16(mf) OTS
295	17-28579	Dep.(nc); $7.60(fs), $2.54(mf) OTS
368	17-27762	Dep.(nc); $3.60(fs), $1.16(mf) OTS
416	17-27602	Dep.(nc); $4.60(fs), $1.43(mf) OTS
488	17-27728	See GEAP-4076
489	17-28429	See GEAP-3771-5
627	17-27651	See GEAP-4135
632	17-27775	See ATL-A-135
633	17-28431	See GEAP-4216
674	17-27543	See NYO-10486
GA-	**(Misc.)**	
3194	17-27782	Dep.(nc); $5.60(fs), $1.82(mf) OTS
4227	17-27783	Dep.(nc); $2.60(fs), $1.10(mf) OTS
4267	17-27784	Dep.(nc); $3.60(fs), $1.28(mf) OTS
GEAP-	**(Misc.)**	
3771-5	17-28429	Dep.(nc); $7.60(fs), $2.54(mf) OTS
3828	17-28527	Dep.(nc); $4.60(fs), $1.55(mf) OTS
3933	17-28430	Dep.(nc); $4.60(fs), $1.64(mf) OTS
3961	17-27536	Dep.; $0.75(OTS)
4076	17-27728	Dep.; $1.50(OTS)
4135	17-27651	Dep.(nc); $3.60(fs), $1.28(mf) OTS
4216	17-28431	Dep.(nc); $1.10(fs), $0.80(mf) OTS
HASL-		
138	17-27592	Dep.; $3.50(OTS)

Report No.	Abstract No.	Availability
HW–		
62762	17-27890	Dep.(mc); $1.10(fs), $0.80(mf) OTS
66728	17-27683	Dep.(mc); $2.60(fs), $0.86(mf) OTS
67376	17-27684	$1.10(fs), $0.80(mf) OTS
69204	17-27758	Dep.; $0.50(OTS)
73394	17-27416	Dep.(mc); $1.10(fs), $0.80(mf) OTS
74359(Rev.)	17-27747	Dep.; $0.75(OTS)
76222	17-28580	Dep.; $1.25(OTS)
76636	17-27729	Dep.; $2.60(fs), $1.10(mf) OTS
77052	17-27730	Dep.; $3.50(OTS)
77126	17-27417	Dep.; $0.50(OTS)
77299	17-28581	Dep.; $1.50(OTS)
HW-SA–		
2756	17-27720	Dep.(mc); $1.10(fs), $0.80(mf) OTS
2775	17-27111	Intern. J. Radiation Biol., 6: 247-55(1963)
2829	17-27836	J. Am. Ceram. Soc., 46: 194-5(1963)
2870	17-28118	Dep.(mc); $1.60(fs), $0.80(mf) OTS
3032	17-28408	Dep.(mc); $2.60(fs), $0.86(mf) OTS
3036	17-27652	Dep.(mc); $7.60(fs), $2.57(mf) OTS
3045	17-28432	Dep.(mc); $1.60(fs), $0.80(mf) OTS
3050	17-27053	Dep.(mc); $1.10(fs), $0.80(mf) OTS
IA–	**(Non-AEC)**	
839	17-27230	Dep.(mc)
IDO–		
11005	17-28433	Dep.(mc); $1.10(fs), $0.80(mf) OTS
11106	17-28441	See MITNE-29
14605	17-27231	Dep.; $2.75(OTS)
16852	17-27653	Dep.; $1.00(OTS)
16858	17-28434	Dep.; $0.75(OTS)
16876	17-27418	Dep.; $0.50(OTS)
16877	17-28435	Dep.; $0.75(OTS)
16890	17-28436	Dep.; $1.25(OTS)
28607	17-28528	Dep.; $1.50(OTS)
INSJ–	**(Japanese)**	
54	17-27562	Dep.(mc)
IS–		
529	17-27843	J. Chem. Phys., 38: 1991-8(1963)
556	17-27357	J. Phys. Chem., 67: 1061-5(1963)
563	17-27358	J. Phys. Soc. Japan, 17: Suppl. B-II, 20-2(1962)
569	17-27785	Dep.(mc); $1.60(fs), $0.80(mf) OTS
614	17-27257	Anal. Chem., 35: 1053-4(1963)
ISS–	**(Italian)**	
63/28	17-28138	Dep.(mc)
JAERI–	**(Japanese)**	
4024	17-27419	Dep.(mc)
JINR–	**(Russian)**	
D-1236	17-28140	Dep.(mc)
E-1252	17-28141	Dep.(mc)
E-1262	17-28142	Dep.(mc)
P-1241	17-28143	Dep.(mc)
P-1245	17-28144	Dep.(mc)
P-1246	17-28145	Dep.(mc)
P-1247	17-27891	Dep.(mc)
P-1253	17-28146	Dep.(mc)
P-1258	17-28241	Dep.(mc)
P-1259	17-28242	Dep.(mc)
P-1261	17-27939	Dep.(mc)
P-1266	17-28147	Dep.(mc)
P-1287	17-28148	Dep.(mc)
JPL-TR–	**(Non-AEC)**	
32-417	17-28360	
32-439	17-27593	
JPRS–	**(Non-AEC)**	
19284	17-27069	$1.25(OTS)
19806	17-27070	$0.50(OTS)
19866	17-27603	$0.50(OTS)
K–		
1571	17-27712	Dep.; $0.50(OTS)
KAPL–		
2000-20	17-28437	Dep.; $2.50(OTS)
2257	17-27748	Dep.(mc); $0.50(OTS)
KAPL-M–		
BEE-1	17-28438	Dep.(mc); $2.60(fs), $1.10(mf) OTS
CC-3	17-27749	Dep.(mc); $4.60(fs), $1.46(mf) OTS
JA-6	17-27721	Dep.(mc); $5.60(fs), $1.82(mf) OTS
JNB-1	17 28439	Dep.(mc); $6.60(fs), $2.27(mf) OTS
RPC-1(Rev.1)	17-28222	Dep.(mc); $3.60(fs), $1.40(mf) OTS
RPC-6	17-28243	Dep.(mc); $4.60(fs), $1.61(mf) OTS
RPC-8	17-28440	Dep.(mc); $2.60(fs), $1.10(mf) OTS
SW-2	17-28244	Dep.(mc); $4.60(fs), $1.70(mf) OTS
KFK–	**(German)**	
120	17-28245	Dep.(mc)
KR–	**(Norwegian)**	
40	17-27420	Dep.(mc)
45	17-28529	Dep.(mc)
46	17-28564	Dep.(mc)
LA–		
2841	17-27315	Dep.; $2.25(OTS)
2860	17-27685	Dep.; $0.75(OTS)
2877	17-27940	Dep.; $1.25(OTS)
2885	17-28572	Dep.; $1.50(OTS)
2892	17-27232	Dep.; $0.50(OTS)
LADC–		
5278	17-27101	Genetics, 48: 341-6(1963)
5517	17-27316	Dep.(mc); $2.60(fs), $0.89(mf) OTS
5522	17-27786	Dep.(mc); $1.60(fs), $0.80(mf) OTS
5523	17-27787	Dep.(mc); $3.60(fs), $1.19(mf) OTS
5527	17-27356	J. Phys. Chem., 67: 952-3(1963)
5535	17-27654	Dep.(mc); $4.60(fs), $1.64(mf) OTS
5641	17-27553	Phys. Fluids, 6: 975-82(1963)
LAMS–		
2895	17-26946	Dep.; $4.50(OTS)
2915	17-28565	Dep.; $0.50(OTS)
LAS-TR–	**(Misc.)**	
199-36*	17-27563	See NP-12932
LNF–	**(Italian)**	
63/21	17-28149	Dep.(mc)
63/31	17-28150	Dep.(mc)
LRR–		
41	17-27788	Dep.(mc); $4.60(fs), $1.67(mf) OTS
MAB–	**(Non-AEC)**	
139-M(R3)	17-27759	
MATT–		
161	17-28348	Dep.; $0.50(OTS)
165	17-28393	Phys. Fluids, 6: 937-45(1963)
MITNE–	**(Misc.)**	
29	17-28441	Dep.; $0.75(OTS)

Report No.	Abstract No.	Availability
MLM–		
1156	17-27789	Dep.; $2.60(fs), $1.01(mf) OTS
MMPP–	(Misc.)	
196-2	17-27057	Dep.(mc); $12.50(fs), $5.51(mf) OTS
NAA-SR–		
7918	17-27317	Dep.; $0.50(OTS)
8086	17-27318	Dep.; $1.60(fs), $0.80(mf) OTS
8304	17-28573	Dep.; $0.75(OTS)
NAA-SR-Memo–		
504	17-27892	Dep.(mc); $1.10(fs), $0.80(mf) OTS
6117	17-27655	Dep.(mc); $1.60(fs), $0.80(mf) OTS
6688	17-28442	Dep.(mc); $1.60(fs), $0.80(mf) OTS
7426	17-27404	Dep.(mc); $3.60(fs), $1.16(mf) OTS
8406	17-28443	Dep.(mc); $2.60(fs), $0.83(mf) OTS
8408	17-27790	Dep.(mc); $1.10(fs), $0.80(mf) OTS
8427	17-28223	Dep.(mc); $11.00(fs), $4.52(mf) OTS
NASA-TM–	(Non-AEC)	
X-884	17-27731	$0.50(OTS)
NASA-TN–	(Misc.)	
D-1656*	17-27537	
D-1756*	17-27941	$0.50(OTS)
NBS-TN–	(Misc.)	
161	17-27594	Dep.(mc); $0.15(GPO)
NCSC–	(Misc.)	
2477-4	17-27634	Dep.(mc); $4.60(fs), $1.58(mf) OTS
NDA-Memo–	(Misc.)	
2123-1	17-28246	Dep.(mc); $3.60(fs), $1.40(mf) OTS
NEVIS–	(Misc.)	
111	17-28151	Dep.(mc); $10.10(fs), $3.92(mf) OTS
113	17-28152	Dep.(mc); $8.60(fs), $3.20(mf) OTS
NIRL-R–	(British)	
4	17-28349	Dep.(mc); $0.98(BIS); 7s. (HMSO)
14	17-27686	Dep.(mc); $0.98(BIS); 7s. (HMSO)
30	17-27687	Dep.(mc); $0.49(BIS); 3s. 6d. (HMSO)
32	17-27942	Dep.(mc); $0.56(BIS); 4s. (HMSO)
NLCO–		
862(Rev.4)	17-27791	Dep.(mc); $2.60(fs), $1.10(fs) OTS
881	17-27732	Dep.; $0.75(OTS)
882	17-27405	Dep.; $0.75(OTS)
NMI–	(Misc.)	
2116	17-27733	Dep.(mc); $2.60(fs), $1.01(mf) OTS
NP–	(AEC File No. for Non-AEC Reports)	
12767	17-27538	
12894	17-27421	Dep.
12897	17-27058	Dep.(mc)
12901	17-27760	
12902	17-27595	
12903	17-27943	
12904	17-28153	
12905	17-27596	
12906	17-27506	
12908	17-27944	
12909	17-28530	Dep.(mc)
12910	17-28444	
12915	17-28566	Dep.(mc); $17.50(fs), $8.54(mf) OTS
12921	17-28361	Dep.(mc)
12924	17-27597	Dep.; Free(Office of Atomic Development, State of N. Y., Albany, N. Y.)
12925	17-28445	
12928	17-27635	Dep.(mc)
12929	17-27636	Dep.(mc)
12932	17-27563	
12933	17-27792	(NASA)
12935	17-28362	
12936	17-27945	
12937	17-27946	OTS
12938	17-27793	OTS
NP-tr–	(AEC File No. for Non-AEC Translations)	
1027	17-27815	Dep.(mc); $2.60(fs), $0.83(mf) JCL
NRC–	(Canadian)	
7370	17-28369	Can. J. Phys., 41: 858-62(1963)
NRL–	(Misc.)	
5882*	17-27598	$3.00(OTS)
5949	17-27794	Dep.(mc); $0.50(OTS)
NYO–		
9773	17-27599	Dep.; $2.75(OTS)
9854	17-27656	Dep.(mc); $8.10(fs), $2.75(mf) OTS
10219	17-27564	Dep.(mc); $12.00(fs), $5.09(mf) OTS
10264	17-28154	Dep.(mc); $1.60(fs), $0.80(mf) OTS Phys. Letters, 5: 165-8(1963)
10426	17-27722	Dep.(mc); $1.60(fs), $0.80(mf) OTS
10486	17-27543	Dep.(mc); $4.60(fs), $1.52(mf) OTS
OKLA–		
2698-2	17-27320	See ORO-602
ORA–	(Misc.)	
5222-1-T	17-27057	See MMPP-196-2
ORINS–		
42	17-26964	Dep.; $1.75(OTS)
ORNL–		
3099	17-27750	Dep.; $1.75(OTS)
3322	17-28582	Dep.; $1.00(OTS)
3357	17-28583	Dep.; $0.75(OTS)
3429	17-28155	Dep.; $1.75(OTS)
3437	17-28531	Dep.; $1.25(OTS)
3438	17-27795	Dep.; $8.60(fs), $3.05(mf) OTS
3447	17-27723	Dep.; $0.50(OTS)
3449	17-27507	Dep.; $1.25(OTS)
3457	17-27059	Dep.; $0.75(OTS)
ORNL-RSIC–	(Oak Ridge National Laboratory)	
1	17-28409	Dep.(mc); Free(ORNL)
ORNL-TM–		
521	17-27796	Dep.(mc); $10.10(fs), $4.01(mf) OTS
585	17-27319	Dep.(mc); $2.60(fs), $0.98(mf) OTS
590	17-28446	Dep.(mc); $2.60(fs), $0.83(mf) OTS
ORO–		
588	17-27233	Dep.(mc); $2.60(fs), $0.95(mf) OTS
602	17-27320	Dep.(mc); $5.60(fs), $1.82(mf) OTS
OTS–	(Misc.)	
62-11755/2 (p.99-100)*	17-27071	$1.50(OTS)
63-21865*	17-27069	See JPRS-19284
63-31095*	17-27070	For translation see JPRS-19806; $0.50(OTS)
63-31118*	17-27603	See JPRS-19866
PAN–	(Polish)	

Report No.	Abstract No.	Availability
382/VI	17-28119	Dep.
414/V	17-27797	Dep.
PATENTS	**(British)**	**3s. 6d. each, U. K. Patent Office**
927,728	17-28503	
927,735	17-27403	
927,757	17-27675	
927,770	17-28103	
927,782	17-28504	
927,883	17-27676	
927,938	17-28355	
928,052	17-27522	
928,111	17-28505	
928,201	17-28506	
928,216	17-28507	
928,227	17-27718	
928,233	17-27883	
928,236	17-28508	
928,394	17-28509	
928,414	17-28510	
928,440	17-27523	
928,454	17-27745	
928,484	17-28550	
928,507	17-27769	
928,517	17-28511	
928,532	17-27884	
928,605	17-27486	
928,622	17-28569	
928,661	17-27524	
928,797	17-27677	
928,834	17-27525	
928,836	17-28551	
928,849	17-27526	
928,853	17-27220	
928,872	17-28552	
928,889	17-27491	
928,915	17-28553	
928,985	17-28554	
928,995	17-28555	
929,022	17-27678	
929,126	17-28512	
929,174	17-28513	
929,204	17-27935	
929,246	17-27221	
929,352	17-27527	
929,463	17-27770	
929,464	17-27771	
929,465	17-27772	
929,580	17-27222	
929,585	17-28570	
929,653	17-27719	
929,681	17-27528	
929,682	17-27557	
929,689	17-28514	
929,784	17-28556	
929,785	17-28557	
929,804	17-28403	
929,838	17-28515	
929,863	17-28586	
929,882	17-28516	
929,896	17-27558	
929,898	17-28404	
929,924	17-28558	
929,941	17-28559	
929,989	17-27559	
PATENTS	**(U. S.)**	**$0.25 each, U. S. Patent Office**
3,093,003	17-27679	
3,093,398	17-27529	
3,093,489	17-27648	
3,093,561	17-27649	
3,093,564	17-28517	
3,093,565	17-28518	
3,093,567	17-28560	
3,093,586	17-28519	
3,093,593	17-28587	
3,093,734	17-27710	
3,093,735	17-28104	
3,093,737	17-27711	
3,093,739	17-27680	
3,093,765	17-28405	
3,093,788	17-28578	
3,094,377	17-27773	
3,094,419	17-27223	
3,094,470	17-28571	
3,094,472	17-27647	
3,094,473	17-28520	
3,094,474	17-28406	
3,094,488	17-27530	
3,094,615	17-28356	
3,094,621	17-27310	
3,094,622	17-27681	
3,094,634	17-27531	
PG-Report–	**(British)**	
437	17-27234	Dep.; $0.17(BIS); 1s. 3d. (HMSO)
444	17-27235	Dep.; $0.21(BIS); 1s. 6d. (HMSO)
453	17-27236	Dep.
454	17-27237	Dep.
463	17-27238	Dep.
467	17-27239	Dep.
PWA–	**(Non-AEC)**	
2197	17-28574	
Q–	**(Misc.)**	
A2392-3-8	17-27510	See TID-18924
R–	**(Misc.)**	
362	17-28151	See NEVIS-111
RADC-TDR–	**(Misc.)**	
62-307*	17-27798	
RAI–	**(Misc.)**	
113	17-28584	Dep.(mc); $1.60(fs), $0.80(mf) OTS
RRL–		
113	17-27406	Dep.(mc); $1.60(fs), $0.80(mf) OTS
RT-GEO–	**(Italian)**	
(63)-25	17-27565	Dep.(mc)
SAM-TDR–	**(Non-AEC)**	
63-17	17-27060	$1.10(OTS)
SAN–		
1020	17-27637	Dep.(mc); $8.10(fs), $2.90(mf) OTS
1021	17-27638	Dep.(mc); $6.60(fs), $2.03(mf) OTS
SB–	**(Non-AEC)**	
62-69	17-27793	See NP-12938
63-6	17-27946	See NP-12937
SC–	**(Misc.)**	
4905(RR)	17-27600	Dep.; $0.50(OTS)
SCDC–		
2046	17-27947	See TID-18816
2047	17-27509	See TID-18844
3125	17-27893	See TID-18843
3126	17-27894	See TID-18856

Report No.	Abstract No.	Availability
3134	17-27895	See TID-18857
3185	17-27994	See TID-18642
3232	17-27898	See TID-18715
3251	17-27724	See TID-18886
SCR-		
600	17-26947	Dep.; $2.00(OTS)
SCTM-		
59-63(25)	17-27508	Dep.(mc); $5.60(fs), $2.00(mf) OTS
SID-	(Non-AEC)	
62-386	17-27885	See AD-282467
SRIA-		
65	17-28532	Dep.; $1.75(OTS)
SRO-		
83	17-28533	Dep.(mc); $1.60(fs), $0.80(mf) OTS
SUI-	(Misc.)	
62-18	17-27990	Ann. Phys. (N. Y.), 22: 169-91(1963)
TID-		
3717	17-26948	Dep.; Free (DTI Extension)
7650	17-28447	Dep.; $8.00(OTS)
7666	17-27734	Dep.(mc); $6.60(fs), $2.03(mf) OTS
8539	17-27713	Dep.; $1.00(OTS)
14705	17-27988	Advanced Energy Conversion, 3: 397-405 (1963)
16941	17-27251	Anal. Chem., 35: 1002-5(1963)
17092	17-27799	Dep.(mc); $2.60(fs), $1.07(mf) OTS
17105	17-27422	Dep.(mc); $6.60(fs), $2.06(mf) OTS
17136	17-27800	Dep.(mc); $1.60(fs), $0.80(mf) OTS
17141	17-27801	Dep.(mc); $2.60(fs), $0.92(mf) OTS
17481	17-28490	IEEE (Inst. Elec. Electron. Engrs.) Trans. Autom. Control, AC-8: 56-8 (1963)
17565(Pt.I)	17-28164	Ann. Phys. (N. Y.), 22: 263-73(1963)
17565(Pt.II)	17-28166	Ann. Phys. (N. Y.), 22: 299-308(1963)
17616	17-27394	Trans. Am. Soc. Metals, 56: 272-7(1963)
17645	17-27148	Laval Med., 34: 163-8(1963)
17651	17-28279	J. Inorg. Nucl. Chem., 25: 627-30(1963)
17966	17-28296	Nucl. Phys., 43: 537-46(1963)
18175	17-28234	Nucl. Sci. Eng., 16: 235-8(1963)
18195	17-27423	Dep.; $1.75(OTS)
18339	17-28176	J. Math. Phys. (N. Y.), 4: 617-21(1963)
18356	17-28318	Phys. Rev., 131: 772-3(1963)
18359	17-27255	Anal. Chem., 35: 1044-9(1963)
18426	17-28414	Science, 140: 1284-90(1963)
18476	17-28261	Ann. Phys. (N. Y.), 22: 373-405(1963)
18616	17-27061	Dep.; $2.75(OTS)
18642	17-27994	Appl. Phys. Letters, 2: 233-4(1963)
18715	17-27898	Appl. Phys. Letters, 2: 235-6(1963)
18722	17-27062	Dep.(mc); $1.10(fs), $0.80(mf) OTS
18788	17-28247	Dep.(mc); $4.60(fs), $1.67(mf) OTS
18809	17-27802	Dep.(mc); $2.60(fs), $0.83(mf) OTS
18815	17-27803	Dep.(mc); $1.60(fs), $0.80(mf) OTS
18816	17-27947	Dep.(mc); $2.60(fs), $0.95(mf) OTS
18837	17-28323	Phys. Rev., 131: 811-17(1963)
18842	17-27804	Dep.(mc); $1.10(fs), $0.80(mf) OTS
18843	17-27893	Dep.(mc); $1.60(fs), $0.80(mf) OTS
18844	17-27509	Dep.(mc); $3.60(fs), $1.22(mf) OTS
18846	17-27063	Dep.(mc); $1.10(fs), $0.80(mf) OTS
18855	17-27064	Dep.(mc); $3.60(fs), $1.22(mf) OTS
18856	17-27894	Dep.(mc); $1.60(fs), $0.80(mf) OTS
18857	17-27895	Dep.(mc); $1.60(fs), $0.80(mf) OTS
18859	17-27805	Dep.(mc); $1.60(fs), $0.80(mf) OTS
18864	17-27054	Dep.(mc); $1.60(fs), $0.80(mf) OTS
18871	17-27761	Dep.(mc); $2.60(fs), $1.04(mf) OTS
18876	17-27806	Dep.(mc); $1.60(fs), $0.80(mf) OTS
18878	17-27013	Dep.(mc); $1.60(fs), $0.80(mf) OTS
18880	17-28481	Dep.(mc); $3.60(fs), $1.34(mf) OTS
18881	17-27639	Dep.(mc); $1.60(fs), $0.80(mf) OTS
18883	17-27240	Dep.(mc); $3.60(fs), $1.22(mf) OTS
18884	17-28224	Dep.(mc); $10.50(fs), $4.37(mf) OTS
18885	17-28225	Dep.(mc); $3.60(fs), $1.25(mf) OTS
18886	17-27724	Dep.(mc); $7.60(fs), $2.54(mf) OTS
18887	17-26949	Dep.(mc); $1.60(fs), $0.80(mf) OTS
18888	17-28482	Dep.(mc); $8.10(fs), $2.90(mf) OTS
18891	17-27807	Dep.(mc); $4.60(fs), $1.61(mf) OTS
18895	17-28483	Dep.(mc); $1.60(fs), $0.80(mf) OTS
18899	17-28248	Dep.(mc); $2.60(fs), $0.86(mf) OTS
18907	17-27896	Dep.(mc); $1.10(fs), $0.80(mf) OTS
18908	17-27241	Dep.(mc); $2.60(fs), $1.04(mf) OTS
18909	17-27541	Dep.(mc); $1.60(fs), $0.80(mf) OTS
18910	17-27542	Dep.(mc); $1.60(fs), $0.80(mf) OTS
18911	17-28484	Dep.(mc); $10.10(fs), $4.01(mf) OTS
18921	17-27948	Dep.(mc); $5.60(fs), $1.94(mf) OTS
18924	17-27510	Dep.(mc); $6.60(fs), $2.30(mf) OTS
18925	17-27242	Dep.(mc); $2.60(fs), $1.07(mf) OTS
TLW-		
1082	17-28484	See TID-18911
TO-B-	(Non-AEC)	
63-6	17-27601	$6.60(OTS)
TRG-Report-	(Non-AEC)	
332	17-27546	Intern. J. Heat Mass Transfer, 6: 397-416 (1963)
UAC-		
5121	17-27988	See TID-14705
6710	17-27799	See TID-17092
6753	17-27800	See TID-17136
6755	17-27801	See TID-17141
6769	17-27422	See TID-17105
6850	17-28490	See TID-17481
6925	17-27990	See SUI-62-18
7004	17-27394	See TID-17616
7097	17-28234	See TID-18175
7255	17-28318	See TID-18356
7331	17-28248	See TID-18899
UCOL-P-		
516	17-27714	Dep.(mc); $1.60(fs), $0.80(mf) OTS
518	17-28249	Dep.(mc); $3.60(fs), $1.31(mf) OTS
UCRL-		
3911	17-27545	Ind. Eng. Chem., Fundamentals, 2: 113-26(1963)
6886(Rev.1)	17-27657	Dep.; $0.50(OTS)
6981-T(Rev.I)	17-28363	Dep.(mc); $1.10(fs), $0.80(mf) OTS
7030	17-27808	Dep.(mc); $2.60(fs), $0.92(mf) OTS
7139-T	17-27841	J. Appl. Phys., 34: 1562-3(1963)
7214	17-28567	Dep.; $2.75(OTS)
7216	17-28320	Phys. Rev., 131: 777-86(1963)
7222	17-26958	Nucl. News, 6: 1-13(1963)
7236	17-27872	Phys. Rev., 131: 657-9(1963)
7267	17-28226	Dep.; $0.75(OTS)
7284	17-27809	Dep.; $2.75(OTS)
7294	17-28364	Dep.; $0.50(OTS)
7298-T	17-27321	Dep.(mc); $1.60(fs), $0.80(mf) OTS
7301-T	17-27322	Dep.(mc); $1.10(fs), $0.80(mf) OTS
7325-T	17-27323	Dep.(mc); $1.60(fs), $0.80(mf) OTS
7922	17-27343	J. Electrochem. Soc., 110: 773-5(1963)
10381	17-28391	Phys. Fluids, 6: 925-31(1963)
10435	17-27839	J. Am. Ceram. Soc., 46: 284-93(1963)
10450	17-28262	Ann. Phys. (N. Y.), 22: 406-37(1963)
10471	17-28049	Phys. Rev., 131: 684-9(1963)
10473	17-27658	Dep.(mc); $1.60(fs), $0.80(mf) OTS

Report No.	Abstract No.	Availability
10512	17-28250	Dep.(mc); $1.10(fs), $0.80(mf) OTS
10557	17-28299	Nucl. Phys., 43: 560-97(1963)
10563	17-28156	Dep.; $2.00(OTS)
10578	17-27695	J. Appl. Phys., 34: 1570-1(1963)
10619	17-27341	J. Electrochem. Soc., 110: 563-9(1963)
10620	17-27324	Dep.; $2.50(OTS)
10637	17-28157	Dep.; $1.75(OTS)
10678	17-28192	Phys. Rev., 131: 868-74(1963)
10689	17-28251	Dep.(mc); $2.60(fs), $0.83(mf) OTS
10693	17-28252	Dep.(mc); $1.60(fs), $0.80(mf) OTS
10696	17-27544	Dep.; $2.75(OTS)
10720	17-28158	Dep.; $2.00(OTS)
10723	17-28159	Dep.; $0.50(OTS)
10724	17-27065	Dep.; $2.00(OTS)
10741	17-28253	Dep.(mc); $3.60(fs), $1.16(mf) OTS
10752(Suppl.)	17-28254	Dep.; $0.50(OTS)
10764	17-28255	Dep.(mc); $1.60(fs), $0.80(mf) OTS
10766	17-28256	Dep.(mc); $1.60(fs), $0.80(mf) OTS
10769	17-27949	Dep.(mc); $1.60(fs), $0.80(mf) OTS
10772	17-28257	Dep.(mc); $1.60(fs), $0.80(mf) OTS
10775	17-28258	Dep.(mc); $1.60(fs), $0.80(mf) OTS
10788	17-27810	Dep.(mc); $4.60(fs), $1.67(mf) OTS
10801	17-28365	Dep.(mc); $1.60(fs), $0.80(mf) OTS
10802	17-27950	Dep.(mc); $1.60(fs), $0.80(mf) OTS
10825	17-28259	Dep.(mc); $1.60(fs), $0.80(mf) OTS
10842	17-28160	Dep.(mc); $1.60(fs), $0.80(mf) OTS
UCRL-Trans-		
921	17-27816	Dep.(mc); $1.10(fs), $0.80(mf) JCL
957(L)	17-27952	Dep.(mc); $4.60(fs), $1.61(mf) JCL
UMRI-	**(Misc.)**	
2431-1-P*	17-28445	See NP-12925
UNC-	**(Misc.)**	
1004	17-27811	Dep.(mc); $7.60(fs), $2.57(mf) OTS
UNM-TR-		
EE-20	17-27724	See TID-18886
USNRDL-TR-	**(Non-AEC)**	
638	17-27640	Dep.(mc); $2.60(fs), $0.92(mf) OTS
640	17-27066	$1.60(OTS)
642	17-28260	Dep.(mc); $2.60(fs), $0.83(mf) OTS
WADD-TR-	**(Non-AEC)**	
61-134(Pt.II)	17-27812	
WAPD-R(WB)-		
2	17-27511	Dep.(mc); $1.10(fs), $0.80(mf) OTS
WAPD-T-		
1376	17-28485	Dep.(mc); $1.60(fs), $0.80(mf) OTS
1392	17-28227	Dep.(mc); $2.60(fs), $1.01(mf) OTS
1485	17-27552	Nucl. Sci. Eng., 16: 218-26(1963)
1501	17-27897	Dep.(mc); $3.60(fs), $1.13(mf) OTS
1530	17-27560	Dep.(mc); $2.60(fs), $1.10(mf) OTS
1567	17-27751	Dep.(mc); $6.60(fs), $2.27(mf) OTS
1589	17-28228	Dep.(mc); $1.10(fs), $0.80(mf) OTS
1591	17-27725	Dep.(mc); $1.10(fs), $0.80(mf) OTS
WCAP-	**(Misc.)**	
3713	17-27813	Dep.(mc); $8.60(fs), $2.99(mf) OTS
3716	17-27493	Dep.(mc); $8.10(fs), $2.81(mf) OTS
WP-	**(Non-AEC)**	
22/5	17-27067	Dep.(mc)

DEPOSITORIES OF USAEC REPORTS

In Countries Other than the U.S.

ARGENTINA
Buenos Aires, Comisión Nacional de Energía Atómica

AUSTRALIA
Canberra, Australian National Library
Sutherland, New South Wales, Australian Atomic Energy Commission

AUSTRIA
Vienna, Zentral Bibliothek der Physikalischen Institute der Universität

BELGIUM
Mol-Donk, Centre d'Etude de l'Energie Nucleaire

BRAZIL
Rio de Janeiro, Instituto Brasileiro de Bibliografia e Documentacao
São Paulo, Instituto de Energia Atomica, Cidade Universitaria São Paulo

BURMA
Rangoon, Union of Burma Applied Research Institute, Atomic Energy Center Library

CANADA
Hamilton, McMaster University
Ottawa, National Research Council Library
Vancouver, University of British Columbia

CEYLON
Colombo, University of Ceylon

CHILE
Santiago, Instituto de Fisica y Matematicas, Universidad de Chile

CHINA
Hsinchu, Taiwan, Free China, National Tsing Hua University

COLOMBIA
Bogota, Instituto De Asuntos Nucleares

COSTA RICA
San Pedro, University of Costa Rica Library

DENMARK
Risö, Danish Atomic Energy Commission

DOMINICAN REPUBLIC
Santo Domingo, Comisión Nacional de Asuntos Nucleares

ECUADOR
Quito, Escuela Politécnica Nacional

EGYPT
Cairo, Atomic Energy Commission

EL SALVADOR
San Salvador, Universidad de El Salvador, Biblioteca de Energia Nuclear

ENGLAND
Birmingham, Central Library
Bristol, Central Library
Kingston upon Hull, Central Library
Leeds, Central Library
Liverpool, Central Library
London, Central Library, Acton
London, Science Museum Library, South Kensington

ENGLAND (CONT.)
Manchester, Central Library
Newcastle upon Tyne, Central Library
Nottingham, Central Library
Sheffield, Central Library

FINLAND
Helsinki, Teknillisen Korkeakoulun Kirjasto

FRANCE
Gif-sur-Yvette, Centre d'Etudes Nucléaires de Saclay
Paris, Académie des Sciences

GERMANY
Berlin, Hahn-Meitner-Institut für Kernforschung Berlin
Frankfurt/Main, Gmelin-Institut
Munich, Technische Hochschule, Bibliothek

GHANA
Accra, University College of Ghana

GREECE
Athens, Greek Atomic Energy Commission

GUATEMALA
Guatemala, Comisión Nacional de Energía Nuclear

HAITI
Port au Prince, University of Haiti

HONDURAS
Tegucigalpa, Comisión Hondureña de Energía Atómica

ICELAND
Reykjavik, University of Iceland, Atomic Energy Library

INDIA
Bombay, Department of Atomic Energy

INDONESIA
Bandung, Java, Bandung Institute of Technology
Djogjakarta, Java, Science Faculty, Gadjah Mada University

IRAN
Tehran, Tehran University Center for Nuclear Studies

IRAQ
Baghdad, Iraqi Atomic Energy Commission

IRELAND
Dublin, University College

ISRAEL
Rehovoth, Israel Atomic Energy Commission

ITALY
Rome, Centro di Studi Nucleari della Casaccia
Rome, Comitato Nazionale per l'Energia Nucleare

JAPAN
Tokyo, National Diet Library

KOREA
Seoul, Office of Atomic Energy

LEBANON
Beirut, American University

LUXEMBOURG
Luxembourg, Ministry of Transport and Electricity

MALAYA
Kuala Lumpur, University of Malaya

MEXICO
Mexico, D.F., Comisión Nacional de Energía Nuclear

NETHERLANDS
The Hague, Reactor Centrum Nederland

NEW ZEALAND
Wellington, Department of Scientific and Industrial Research

NORTHERN IRELAND
Belfast, City Library

NORWAY
Lillestrom, Institutt för Atomenergi

PAKISTAN
Lahore, West Pakistan, Atomic Energy Centre

PERU
Lima, Junta de Control de Energia Atomica

PHILIPPINE REPUBLIC
Manila, Philippine Atomic Energy Commission

POLAND
Warsaw, Biura Pelnomocnika Rzadu do Spraw Wykorzystania Energii Jadrowej

PORTUGAL
Sacavem, Junta de Energía Nuclear

REPUBLIC OF SOUTH AFRICA
Pretoria, Atomic Energy Board Library

REPUBLIC OF THE CONGO
Leopoldville, Université Lovanium

SCOTLAND
Glasgow, Mitchell Library

SPAIN
Madrid, Junta de Energía Nuclear, Biblioteca Documentación y Publicaciones, Ciudad Universitaria

SWEDEN
Nyköping, Aktiebolaget Atomenergi

SWITZERLAND
Zurich, Institut für Physik, Eidg. Technische Hochschule

THAILAND
Bangkok, Office of the Thai Atomic Energy Commission, Department of Science

TURKEY
Ankara, Turkish Atomic Energy Commission, Atomic Energy Library

URUGUAY
Montevideo, Comision Nacional de Energia Atomica

VENEZUELA
Caracas, Instituto Venezolano de Investigaciones Científicas

VIET-NAM
Dalat, Institute of Nuclear Research, Atomic Energy Office

YUGOSLAVIA
Belgrade, Federal Commission for Nuclear Energy

In International Agencies

AUSTRIA
Vienna, International Atomic Energy Agency

BELGIUM
Brussels, La Bibliotheque EURATOM

FRANCE
Paris, European Nuclear Energy Agency, O.E.C.D.

ITALY
Ispra, EURATOM Research Center

SWITZERLAND
Geneva, United Nations Library

UNITED STATES
Washington, D. C., Inter-American Nuclear Energy Commission

UNITED STATES
GOVERNMENT PRINTING OFFICE
DIVISION OF PUBLIC DOCUMENTS
WASHINGTON 25, D. C.

OFFICIAL BUSINESS

PENALTY FOR PRIVATE USE TO AVOID
PAYMENT OF POSTAGE, $300
(GPO)

3619

TO AVOID
$300